Electrical World and Engineer

THE CONSOLIDATION OF "THE ELECTRICAL WORLD" AND "THE ELECTRICAL ENGINEER."

VOL. XXXIV. NEW YORK, SATURDAY, OCTOBER 7, 1899. No. 15.

PUBLISHED EVERY SATURDAY BY

ELECTRICAL WORLD AND ENGINEER

(INCORPORATED.)

120 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 4044 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

CHICAGO OFFICE, - - - - - - 936 Monadnock Block.
PHILADELPHIA OFFICE, - - - - - - - 929 Chestnut Street.

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Change in advertisements intended for a particular issue should reach the office of the ELECTRICAL WORLD AND ENGINEER on or before MONDAY morning of the week of issue. New advertisements can be received up to 10 A. M. of Tuesday of the week of issue.

TERMS OF SUBSCRIPTION.

United States, Canada or Mexico . . . . . per year, $3.00
Foreign Countries within the Postal Union, ... 6.00
Single Copies, ...10

In requesting your address changed give OLD as well as new address.

(Entered as second-class mail matter at the New York Post Office.)

NEW YORK, SATURDAY, OCTOBER 7, 1899.

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SLOW TELEPHONY.

Although men have to put up with a good deal of delay in making telephone calls, and may sometimes have ground for complaint because they cannot get quickly into communication, none of them, so far as we are aware, have ever brought a suit against any telephone company on that account. It may be that chivalry prevents them from pushing to that extent their grievance against the hard-working, tired little girl at central. But when a woman has something she wishes to tell to the wind or waves or wires, she can endure no impediment. The three great modern means of communication are said to be telegraphy, telephony and tellawoman, and the third method resents greatly any inefficiency in the other two.

Thus it comes about that at Indianapolis, because the telephone girls did not answer her calls quickly enough, Mrs. Mary A. Slocum has filed suit for $150 damages against the Central Union Telephone Company. She says the operators refused to answer her calls. Manager Hill claims that it must have been due to trouble on the lines, as the operators cannot tell where a call comes from, and could not discriminate, even if they wished to. Besides, when there is a woman on the wire, the dear girls would not for worlds choke back her eloquence. They would much prefer to hear what she has to say in such a hurry.

TRUSTS.

The subject of trusts has lately been the theme of much oratory and the cause of no small amount of "conferencing" out west, but it cannot be said that public opinion on the subject is at all clarified by the discussion. If trusts are a bad thing, there can be no question that remedies will be found and enforced, but the public has by no means made up its mind yet that the various movements towards consolidation, combination and concentration are altogether bad. What happened before Runnymede may be left out of account, but ever since then this people has apparently been signing Declarations of Independence only to fall under some new tyranny which somehow leaves it freer than ever, with a larger aim and a wider scope of action than it ever enjoyed before. And so the forces of individual disintegration and of social cohesion struggle and balance, and the "trust" central station idea of supply is so popular that 50,000 down-trodden families from among the masses order from a popular dry goods store a Dewey dinner of only fifteen items and five courses, for five people, for one dollar, with a bottle of claret thrown in. Talk of your trusts! They are child's play after that, and the individual cook or toilworn mother slaving to prepare a scant meal in a little back kitchen has every reason to rebel and become a petroleuse because deprived of her occupation.

PERMANENCY OF ELECTRIC STANDARDS.

It is interesting to notice as a conclusion from the Report to January, 1899, of the Berlin Reichsanstalt, that the limits of variation of resistance and e. m. f. standards are very small under carefully selected conditions. It is stated that the variation occurring during six years, between standard resistances of manganin alloy, was less than one part in 30,000. Not only is the Clark standard cell capable of retaining uniformity of e. m. f. within very narrow limits, but the e. m. f. of this cell, as determined in different parts of the

world seems to be very nearly the same; namely 1.433 International volts at 15° C. The only variations in properly constructed standards of resistance and e. m. f. seem to be those due to temperature changes, and the degree of accuracy with which such standards can be compared and adjusted appears to be limited only by the accuracy of temperature measurements.

Electric current being a kinetic phenomenon, we can scarcely expect to keep a standard of current on our shelves, but dynamometers capable of measuring standard currents have attained great accuracy in their determinations. The standard air condenser and the standard magnetic field are less frequently used and less convenient to measure, but are nevertheless capable of use, when necessary, with a high degree of precision, and a precision very considerably greater than that which we may at present expect in a standard of light.

ELECTRO-THERAPEUTIC TERMINOLOGY.

In regard to electro-therapeutists, we have no words for them save of encouragement. They seem to control the only known means of directly acting upon the interior tissues of the body without using the knife. It is only reasonable to suppose that a judicious use of so potent an agent as electricity, which can permeate all the tissues, should be capable of exerting important alternative metabolic and therapeutic influence beyond reach of all save the operating knife. But some electro-therapeutists seem to forget that the power they employ is essentially a physical agent, and as such should it be treated on its own side from the standpoint of physics. The whole system of electrical nomenclature in current use by therapeutists, involving such terms as galvanic currents, faradic currents, static-induced currents, Morton currents, Tesla currents, Edison currents, etc., is archaic and retrogressive when not ridiculous. There is no objection to the use of such terms considered as connoting special modes of treatment, but they are mischievous because they are antagonistic to the now well-established principle that there is but one electricity and one magnetism, although there are many modes of action and production of either, and many varied phenomena depending for their existence upon the specific mode of action or production. A revision in the recognized terminology of electrotherapy is urgently needed in order to bring the agency into line with the modern development of physics. Pantheistic worship at the shrine of some particular electric wave or high-sounding current should be abolished, if ridicule upon the profession is to be avoided.

EXPORT TRADE.

One of the objects of the present issue of this journal is to emphasize the importance of the export electrical trade and to assist in its development. That such trade has already taken large proportions is proven not merely by statistics but by such a series of articles as appear in this number, showing the use of American electrical apparatus in countries so varied and regions so separated as England, Russia, the Sandwich Islands and the West Indies.

As to the figures of such trade, it may be noted that they show a steady growth. Electrical machinery amounted to $250,462 in July this year, as compared with $161,481 in July last year, and the total for the seven months was $1,598,039, as compared with $1,296,592. Stationary engines, parts and boilers show a gain from $131,000 in the month to $206,000, and the gain in "instruments," which includes telephones, telegraphs, lamps, etc., for the month was from $240,000 up to $653,070. To sum up, in the four departments or branches of export trade referred to, the amount for seven months in 1898 was $3,806,230, but for the seven months this year it reached no less than $5,645,469. And the gain goes on, for while detailed figures are not yet available, the gross figures show that for the eight months ending with August, the exportation of manufactures is $45,000,000 more than in the corresponding months of last year, a gain at the remarkable rate of 22 per cent.

How best to reach the foreign market is a matter in which many American manufacturers have still something to learn from their shrewd and experienced English or German competitors. But this is a day when data and information are readily obtainable, and we hope to do our share in laying it before our American readers, while at the same time introducing them to possible customers abroad. This journal has already a large foreign circulation, but is likely under the newer conditions of foreign trade to fall into the hands of some abroad who have not seen it before. To such new friends we desire to offer our services as an intermediary in bringing them in closer touch with producers in this country, and to express the hope that such efforts to promote American export trade and international welfare will not be in vain. It may be pointed out that in this issue appear articles by Prof. F. B. Crocker, Dr. Eastlake and Mr. Johnston, all of whom discuss such foreign trade helpfully from the standpoint of those who have been over the ground.

THE DISTRIBUTION OF THE ELECTRIC CURRENT IN A CONDUCTIVE SUBSTANCE.

A paper recently read by Mr. Elmer Gates, "On the Distribution of the Electric Current in a Conductive Substance," before the American Electro-Therapeutic Association is abstracted in another column of this issue. The paper was accompanied by graceful arborescent "electrographs" and contains some remarkable conclusions. Mr. Gates seems to have been endeavoring to obtain experimental evidence as to whether electric currents travel through the dielectric outside a conductor or through the conductor itself. His effort and endeavor command respect, and the experimental results speak for themselves. As all who are familiar with high pressure dielectric strength tests are aware, a spark discharge will commonly strike a glass plate squarely, and then radiate over its surface in all directions. But how it can be considered that this reveals the distribution of electric currents in conducting or in non-conducting media seems to us a mystery. When we ordinarily speak of the flow of electric current in a body we conceive of a steady process taking place continuously. On the other hand the phenomena developed and photographically registered by Mr. Gates are momentary disruptive discharges in which the dielectric has broken down in a number of directions.

It is as though we tried to deduce from a study of the radiating lines in a starred pane of glass broken by a projectile, the laws of the conduction of sound through a vitreous medium. One is the instantaneous record of sudden impulsive stresses, the other is the continuous transmission of elastic waves. It is quite possible that Mr. Gates' "electrographs" may lead to justifiable conclusions in relation to the distribution of spark discharges delivered to the surface of the human body, although even in this case the difference between a glass plate and a conducting human being are sufficient to throw the evidence out of all comparison. But to conclude, as Mr. Gates seems to do, that a steady electric current, or the so-called galvanic current of electrotherapeutists, when passing through the human body, does not diffuse itself through the substance of the moist tissues, but ramifies in definite radial arborescent paths, is simply absurd.

There can be no reasonable doubt, from experiments on electro-osmotic diffusion in living tissues, as well as from the well-established laws of current distribution in non-living cellular tissue saturated with saline solution, that a steady electric current in passing through those tissues diffuses through them or permeates them in

essentially the same manner as it would through an electrolytic solution contained in an insulating vessel of similar contour.

As for the underlying phenomena concerning the transmission of the electric current through space, Mr. Gates' interesting experiments are still more remote in their bearing from this question. We think that upon a review of all the evidence on this subject there can be no doubt but that electrical energy is transmitted through non-conductors along the surfaces of conductors. Wireless telegraphy and sunlight or starlight are experimental evidences of the transmitting powers of non-conductors in the absence of conductors.

Low Tension Alternators.

The habit of winding alternators for high pressures is so firmly established that even where the machines deliver their output only to step-up transformers for long distance transmission purposes, the generators are as a rule wound for the conventional alternating current pressures—1000 or 2000 volts—or for 500 at least. The chief disadvantage of alternating current systems being in the transformer losses, it would seem that in some cases of congested loads it would be advisable to design the alternator directly for the pressures delivered to the lamps and motors. The advantages of such a course are pointed out in the article on "Alternating Generators for Direct Service," written by Mr. Alton D. Adams, and appearing on another page of this paper.

There are many central stations which necessarily have to use alternating currents to reach outlying districts, but which have a greater portion of their load near the station. This heavy load may be supplied by special direct-current machinery or by large transformers feeding a secondary network. The former arrangement, which is the more common one, involves two radically different systems with separate generators, switchboards and network, and between which motors and arc lamps are not interchangeable. The alternative of large transformers and secondary networks brings in all the well-known disadvantages of transformer systems, although these are of course a minimum with large machines.

Where the central station is located in or near the district of heavy loads, it may under certain circumstances prove advisable to install one or more alternating dynamos generating directly the voltage delivered to the low-tension network. These low-tension machines could carry the concentrated load, and during the daytime the district which they might serve could be expanded and a large number of transformers could be thrown out of service at those hours when their low-efficiency and magnetizing currents are most harmful. With a single low-tension network well tied together as in Edison systems, the direct low-tension feeders from the low-pressure machines would serve to carry the day load of a large area, the outlying portions of which could be lifted during the evening by transformers supplied from the high-tension machines. If, as seems likely, English practice of three-wire systems with 450 volts between the outer conductors is followed in this country, the low-tension district of an alternating system could thus be made to cover the whole urban portion of a central station's territory, the high-tension district containing solely the suburban areas.

Small inductor-type machines are now on the market in which, by means of a few changes of the end connections, the pressure generated can be altered from 2000 or 1000 to 200 or 100 volts, or both high and low pressure can be simultaneously generated. It would be a simple matter to wind large direct-coupled machines—especially if they are of the revolving field type—in the same way, so that one machine could deliver part of its rated load at high pressure and the rest at low pressure; or it could have its coils switched over at different times of day from one arrangement to the other. One machine could thus be made a reserve on either system, or by connecting it for simultaneous generation, could be made to keep the high and low-pressure systems in synchronism and phase with each other. The latter object could also be attained by a transformer of suitable size connecting the two. The advantage of such a combined system over high-tension alternating and low-tension direct currents are obviously many.

Celebrations and Electricity.

During the past week, electricity in its various industrial manifestations cut a bigger figure than in any previous affair whether here or abroad, but the day for wonderment at its brilliant or useful effects has certainly gone by. We can well remember that at the Columbian celebration in 1893, the people were all agog to see the play of searchlights. Last week searchlights were flashing everywhere, but nobody had a word to say about them except at the Dewey Arch. Even the colossal sign of 8000 incandescent lamps on the Brooklyn Bridge was taken very calmly, while very few photographers cared or dared to "snap" it. On the whole this placid acceptance of all the wonders and benefits of electrical application is encouraging. Electric lights and trolley cars are now an essential part of daily life.

It is better that people should use these things than marvel idly at them, and there can be no mistake as to the increasingly generous use made of electricity. Moreover, strangers who were in New York last week will want a repetition of the effects that they saw, when the times arrive for local celebrations, and thus the area of electrical work has been enlarged once again by the great Dewey week.

Wireless Telegraphy.

The first day of the international yacht race off Sandy Hook witnessed another triumph of the wireless telegraph, which was operated under the personal direction of Marconi. With but three "breaks" in a total of 59 messages, and 46 consecutive messages received without a flaw, the performance may be considered to practically equal that of ordinary telegraphy. The successful results obtained are the more interesting from the fact that the work was not undertaken as a test of the system, but as a matter-of-fact application of it to practical purposes, not differing in this respect from the arrangements made to transmit the Marconi messages by cable from the receiving ship to the shore. It is true that the distances were comparatively small through which the messages reporting the stages of the yacht race were transmitted. As we go to press, however, our English exchanges bring accounts of a no less successful operation of the Marconi system between Dover and Boulogne, during the simultaneous meetings at those respective places of the British and French Association for the Advancement of Science, one of the features of which was the exchange of greetings by wireless telegraphy.

In view of the tests to which the Marconi system has thus far been submitted, it seems safe to assume that it has reached an entirely practical stage, and is now ready for application to everyday work. The extent of the field for its application is, as yet, however, a matter which awaits determination, but that wireless telegraphy will play a large part in warfare and navigation seems certain. A trial of the system to be made this fall during the naval manœuvres will probably definitely settle the former question, as the installation for communicating with the Goodwin Sands lightship has already settled the latter in the affirmative. Whatever may be the outcome, the greatest credit will attach to the brilliant Anglo-Italian through whose efforts radiant telegraphy has been developed from a useless laboratory stage to a practical system. As an inventor it is probably not too much to say that he has shown qualities which rank his name even among the greatest in the field of invention.

First Day of the International Yacht Races on Board the Mackay-Bennett.

In the first of the Cup races off Sandy Hook on Tuesday last, the cable steamer Mackay-Bennett fully justified its reputation for the highest efficiency of equipment. Installed on its main deck was a complete telegraph and cable office, into which messages from press representatives poured all day. Connection was also made with the Atlantic cable, and while the details of the race were being sent into New York, messages were being despatched to Europe. On the invitation of Mr. George G. Ward, vice-president and general manager of the Commercial Cable Company, a large party, including many representatives of the press, were entertained on board the Mackay-Bennett, which was anchored during the race off Sandy Hook lightship. The most interesting feature of the occasion, as might be expected, was the receiving station of the wireless telegraph service. The messages sent by M. Marconi, on board the Ponce, which followed the competing yachts, were received practically without a hitch, by Mr. T. Bowden, Mr. Marconi's assistant in charge. The service was a remarkable vindication of the practical value of the system. About 60 messages were received and promptly transcribed. Only at the 47th message was there any necessity of asking for the repetition of a word from the operator on the Ponce, and the interruption occupied only a few seconds. The results were a strong testimony to the adaptability and flexibility of the system so carefully and laboriously brought to its present effective stage by Mr. Marconi, and there can no longer be any doubt as to the success of wireless telegraphy. Moreover, Mr. Marconi has always shown himself able to do more than he promised, and his caution and conservatism have had the effect of inspiring much confidence in the further possibilities, as outlined by him, of the wireless transmission of messages through space. After taking his instruments, which had just been landed from England, out of the Customs, Mr. Bowden had only four hours in which to put them up and adjust them on board the Mackay-Bennett, and yet their operation was absolutely perfect. Among the guests of the Commercial Cable Company on board were W. H. Baker, general manager Postal Telegraph and Cable Company; Minor M. Davis, in charge of the telegraph service on board; Charles E. Merritt, representing Mr. G. G. Ward; Charles Cuttriss, electrician of the Commercial Cable Company; S. F. Jones, Arthur Brown, S. F. Austin, of the executive department, in charge of the cable service of the Commercial Cable Company, and representatives of the *Electrical Review* and the ELECTRICAL WORLD AND ENGINEER. The visitors, in the safe hands of Mr. Cuttriss, had a most enjoyable day, and Mr. C. Priest, the electrician of the Mackay-Bennett, and Mr. Bowden, in charge of the Marconi service, extended every facility for information to the press. It may be noted that the vertical wire on the Mackay-Bennett ran up about 125 feet, on one of the masts.

Trade With Modern Japan.

BY W. DELANO EASTLAKE.

Very appropriately has a recent writer on Japan spoken of that country as "the America of the Orient." History has no parallel to offer regarding the rapid advancement of any other country which even approximates the enormous strides forward Japan has made within comparatively few years, save our own land. The progress, indeed, has been so startlingly rapid that the world at large and the business world in particular is still scarcely awake to the changes that have taken place, and are yet prone to regard the "Land of the Rising Sun" as the home of cherry blooms, daintily costumed maidens, quaint customs, fans and tea. In a measure they are right in this even to-day, for in spite of advance Japan still retains all the romantic picturesqueness which was its charm when Commodore Perry opened the country to the world a half a century ago. Few of us here in the States, however, realize that Japan is now not only one of the acknowledged powers of the world in a diplomatic but also in a business sense.

The country has a total population of over forty-three millions, while Tokyo, its capital, has one of over a million and a quarter. Only two months ago did the leading powers of the world show their recognition of Japan's high standing by placing it on a footing equal to themselves, and permitting their subjects to be governed in Japan by Japanese laws. In consequence, the foreign concessions have been abolished, and all foreigners are free to travel or reside in any part of the country they may desire, and more than this, they are permitted to trade in any part of the country, whereas in former times all trading with the outside world was practically restricted to the treaty ports. It is natural to suppose that this altered state of affairs should act as a decided stimulus to trade, and it rests with the manufacturers of this country whether or not America shall participate in this advance.

In this connection a few statistics will serve as an illustration. In 1881 the total imports of Japan amounted to 31,128,125 yen, of this goods to the value of 1,781,108 yen came from the United States, while England's share amounted to 16,364,740 yen. In other words, England's share in the imports was 52.57 per cent., while this country's was only 5.72 per cent. In 1898 Japan's total imports amounted to 274,599,260 yen, and of this the value of the American imports were 40,001,097 yen, or about twenty million dollars gold, while the value of importations from the United Kingdom amounted to 62,707,572 yen, or nearly thirty-two million dollars. America's percentage was 14.57, England's was 22.84. On the other hand the United States has always been Japan's best customer.

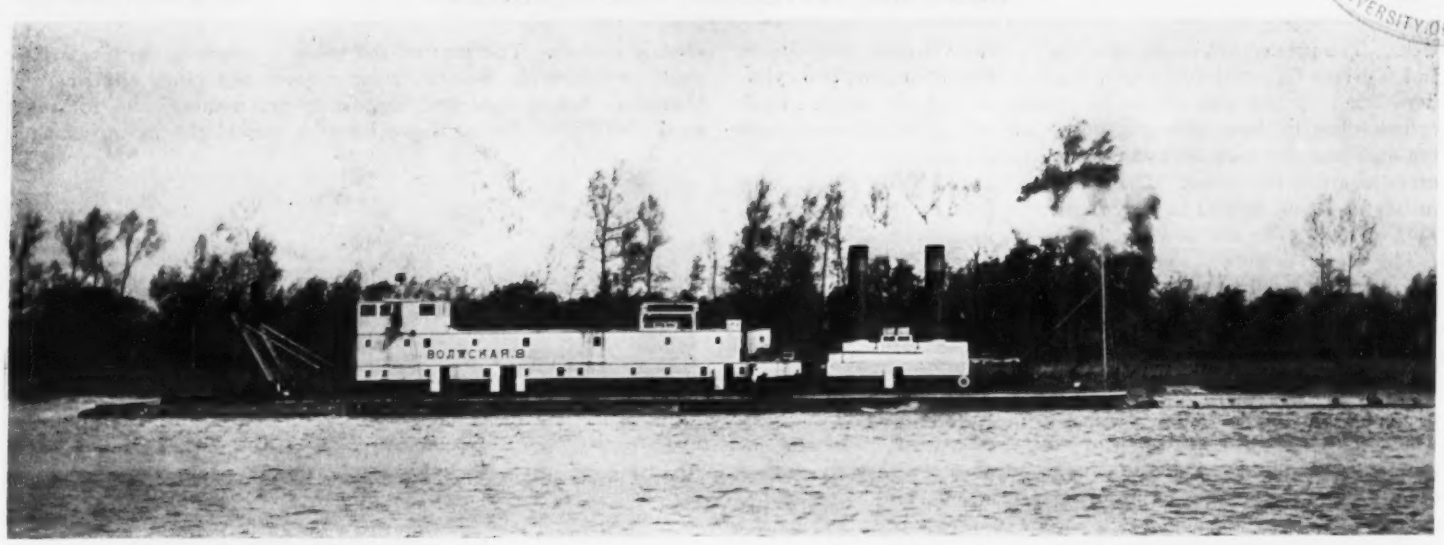
One cannot with justice attribute America's small share in the exports to Japan to any preference on the part of the Japanese to deal with other countries, or even to the fact that they can buy cheaper elsewhere. On the contrary, Japan is and has been doing all she possibly can to stimulate trade with the States, and it would seem rather that the fault lies with the manufacturers and exporters of this country directly, for certainly there has been an absence of "push" and a lack of interest that is most deplorable. The business has been left almost entirely in the hands of commission houses in the various treaty ports, and it has only been very recently that our manufacturers have realized the advisability of establishing agencies in the Orient. Again a sort of mortal dread seems to have existed in the minds of our manufacturers of any direct dealings with the Japanese themselves, and it would seem that most of our firms here consider the words "honesty" and "Japanese" irreconcilable. There may be some justice, or rather some excuse for this, for certainly in times gone by the man who simply bought and sold for a living in Japan had a lower social status than the humblest carpenter or weaver. But those days are over and to-day business integrity means as much in Japan as it does in this country and there are firms galore, purely native, whose financial standing and reputation is of the highest. Japan is a rich country as far as natural products are concerned, but much is still awaiting development. All the same the oil wells of the country are now paying 50 per cent. dividends, while the iron and copper industries pay from 15 to 30 per cent. Other lines are in proportion enormously profitable and could be made still more so if properly developed. It must also be remembered that while there are now some 3000 miles of railroads in Japan, and over a thousand miles more in course of construction, and that there are a number of street railroad lines, yet many more are needed and demanded, and several companies already exist, with ample capital, which have applied for charters from the authorities. It must also be remembered that electricity is now largely used for lighting purposes in Tokyo and other cities and is destined to supersede almost all else in the near future. Again, electricity as a motive power is gaining ground with marvelous rapidity, and its future is assured.

The Japan-American Association of Tokyo and New York is an institution similar to that of Dun's or Bradstreet's, through which the standing and credit of Japanese firms may be easily ascertained, and which stands ready to render all assistance possible to prospective exporters.

We must therefore forget that besides being a land of music and flowers, of fragrant tea and quaint customs, that it is also a land of commerce, that it has its railroads and street cars, its ever increasing factories, its incomparable postal and telegraph systems, its business colleges and educational institutions in all branches of a standard that ranks them with any in the world, and beyond this it is a land that is holding outstretched hands to our manufacturers and offering to them unexceptional advantages.

To summarize, there is now an increasing market for machinery of various kinds, machine tools, wood and metal working machinery, engines and boilers, mining machinery, oil well supplies, electric lighting and power plants, printing presses and railroad supplies in general. Direct representation and direct dealings with the native consumers will secure for manufacturers in the United States a far better percentage of Japan's import trade than they have heretofore enjoyed.

ENGINEERING SOCIETY LIBRARY, UNIVERSITY OF MICHIGAN



American Electrical Dredges on the Volga River, Russia.

ONE of the most recent and interesting examples of electrical and civil engineering development has been the application on the Volga River of high powered suction dredges, designed for the purpose by Mr. Lindon W. Bates, an American engineer. These dredges have recently passed through a series of very successful trials at Antwerp, and a new era in dredging and channel cutting work would appear to have been reached. The *Beta*, built by Mr. Bates for our own government, had already made the remarkable record of 7800 cubic yards of material dredged and removed in one hour. The present machine was given for construction to the Société Cockerill, of Belgium, one of the largest iron and shipbuilding companies on the Continent. It is this dredge which has just been completed and exhibited on the Scheldt near Antwerp.

The dredge is constructed really in two parts, as her breadth is limited to the width of the Canal System "Maries," through which she has had to pass from the Baltic to reach the Volga. This double dredge can be operated as a whole, making a bottom cut 62 feet wide, or each half can be operated separately. Each half measures 216 feet by 31½ feet wide and 9 feet deep. At light draft the hull draws 4 feet; the working draft is 8 inches greater.

The Volga dredge is electrically self-propelling and controllable, the electric installation of each half consisting of a 600-kw generator directly connected to a fore and aft triple expansion engine. The

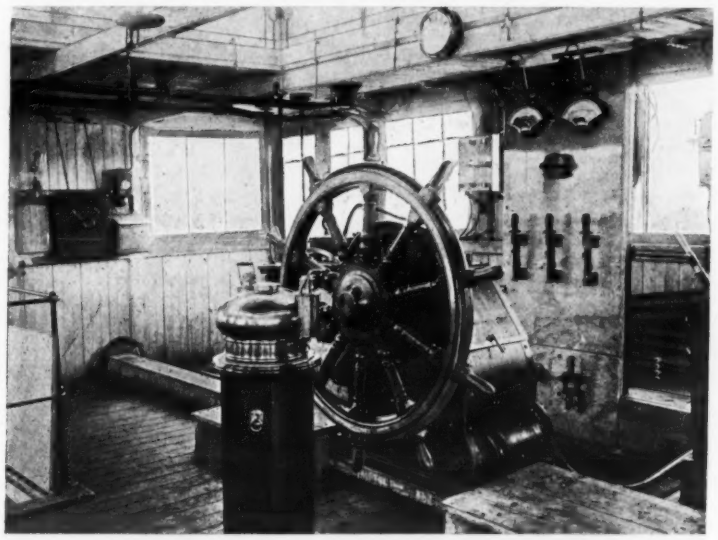


FIG. I.—THE PILOT HOUSE, SHOWING SWITCHBOARD.

generator supplies two stern motors and two bow motors, each of 125-hp, actuating 4-foot screw propellers. The generators also supply power to two 30-hp motors mounted in the distributing pontoon and arranged to control the position of the pontoon line as required by operations. Lighting is done from a separate installation. The control of all motors is centralized in the pilot house. Quarters are provided for the crew and government engineers on each hull.

The pipe pontoons are elliptical air jackets, reversible, and not easily affected by wind, waves or currents. Metal joints are used,

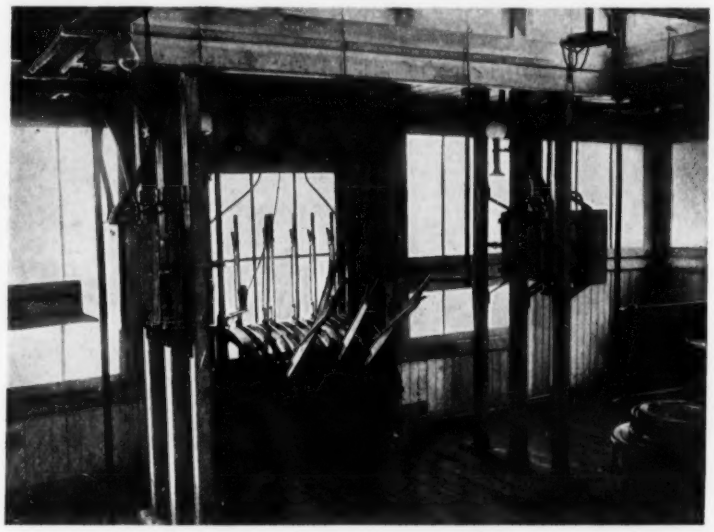


FIG. 2.—PILOT HOUSE.

as these do not obstruct the discharge stream so much as rubber connections. Each pair of compound cutter engines actuates four cutters. Each main pump engine can develop 1500 I. H. P. The tender is a stern-wheel steamer with a speed of ten knots an hour.

Mr. Bates in designing the Volga dredge did not set himself so much the task of exceeding the former capacity trials (output must always have a ratio to the size and power of engines), but rather the task of supplementing the first achievement by the addition of self-actuating features, which would eliminate the loss of time in manœuvring and in adjusting lines. The general arrangement of the dredge is well shown on the accompanying general plans, and the machine is illustrated in various stages and from various points of view in the other illustrations. A brief description of some of the special features will be given.

Each of the two similar hulls is built entirely of steel, with a 3-inch pine deck and a light frame deck house. Near the bow are recesses for the suction ladders and their bearings, and farther back the hull is cut away on each side to provide space for a screw propeller. There are twin screws and rudders. The interior of the hull is divided by transverse bulkheads into watertight compartments. Throughout the central part of the boat for three-fourths of its length there is a double bottom, which is in turn divided by longitudinal keelsons and watertight floors into compartments, each of which is provided with an ejector for removing water.

The heart of such a plant is the main centrifugal pump, and much depends upon its proportions and power. The runner is of cast steel and the shaft is a steel forging. The casing is in iron, cast in five sections, each of which may be replaced according to relative

wear. The runner will make from 150 to 180 revolutions per minute, and is driven by a divided vertical triple expansion engine, two cylinders being on one side of the pump and two on the other. Each cylinder has its own eccentric, the valve motion being variable in the high pressure cylinder and fixed in the others. A throttling governor controls the speed. The proportions are: H. P. cylinder, 21 inches; I. P., 34 inches; L. P., 39 inches; stroke, 24 inches; I. H. P., 1425 to 1600. The engine weighs complete 45 tons.

The engine driving the electrical generator is of the usual vertical marine type, triple expansion, three cylinders, working on three cranks. Cylinder diameters are: H. P., 14¼ inches; I. P., 22¾ inches; L. P., 37⅜ inches; stroke, 24 inches. The diameter of the main shaft is 7⅜ inches, the I H. P. 800; revolutions, 200 per minute, and total weight of engine about 25 tons. A large governor acts on the valve gear of the high-pressure cylinder, regulating the speed. The cutters are driven by a pair of horizontal tandem compound engines placed side by side, with shafts coupled together to quarter cranks. A throttling governor of the Pickering type acts on the common steam pipe. These engines are very compact; substantial guides maintain the cylinders and shaft in relative position and there is no bedplate. Each engine complete, with shaft, weighs 6 tons. A 10-inch centrifugal pump provides the circulation in the surface condenser. The upper part of the latter forms a feedwater heater.

One feature of the dredges which has given great satisfaction is the installation of water-tube boilers, they being of the Babcock & Wilcox marine construction. There are four of these boilers on each

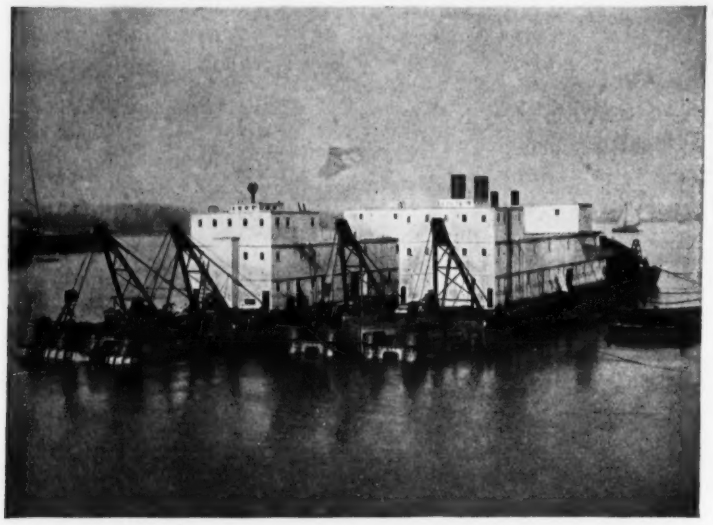


FIG. 3.—VIEW OF DREDGES.

hull half, making eight in all, with a total heating surface of 17,200 square feet. The boilers are fired exclusively with naphtha. There are four burners fitted to each boiler in the dredge and two in the stern-wheeler. The spraying of the naphtha into the furnace is accomplished by a steam jet. On the official trials, which took place on the 24th and 29th of May, the boiler worked without a hitch, giving an abundance of steam. On the full power trials, with all the machinery running, no trouble was experienced in keeping the water level constant, or in getting a sufficiency of steam, although working a very high rate of evaporation, which would be, judging from horsepower of engines, nearly eight pounds of water per square foot of heating surface per hour. The combustion of the naphtha was very good, practically no soot being formed on the heating surface. The temperature taken of the funnel gases showed these to be low, i. e., about 500 degrees.

The pilot house or operating room is on the third deck in the forward part of the deck house. It is placed above the cabins, and large windows on all sides permit a clear view of surroundings. Against the front of the room and in the centre of the boat is a stand of levers, which are connected to operate the friction clutches and brakes of a four-drum hoist below, the steam valve of the hoist and the reversing gear. In addition the steam controlling gear of the engine driving the cutters is also operated from the place, putting all cutter movements under the operator's hand. A complete system of signal and alarm bells, cords to three steam whistles, speaking tubes and a telephone to the end pontoon are within reaching distance. At the sides of the operator are the switches and controllers for the electric motors. The rear of the room is taken up with a marble panel switchboard, rheostat, compensators and other electrical appliances. Ample light and ventilation are assured, and for night work there is an electrical projector or searchlight above, which is

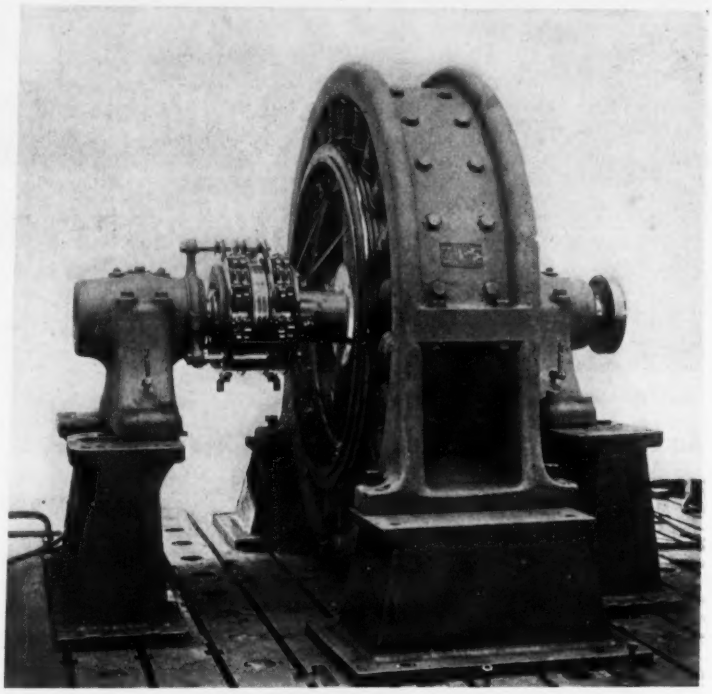


FIG. 4.—600-KW THREE-PHASE GENERATOR.

controlled from below and can be directed where wanted. A steam steering wheel occupies the centre of the room.

That the mixture of solid matter and water shall be of the right proportion for the best output of material, four Bates cutters are mounted on each hull. In order that work may be done at different depths, these cutters through proper mechanism raise and lower on a fixed horizontal axis on the dredge; the cutters may descend to a depth of 16 feet. The cutter engine, located in the forward part of the hull, drives a countershaft, which coincides with the horizontal axis of cutter movements. A pair of mitre gears transmits the power

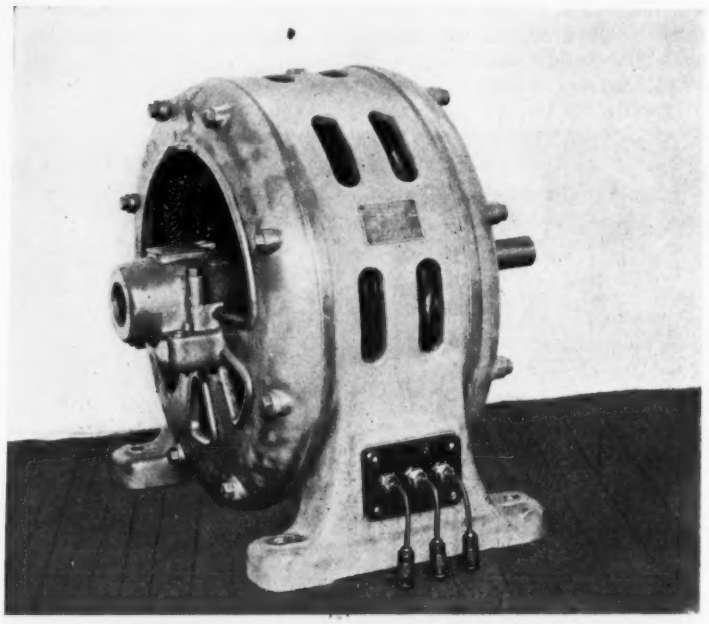


FIG. 5.—125-HP PROPELLER MOTOR.

to the ladder shaft, which carries at its outer end a bevel gear engaging one on the head of the cutter shaft. Inside and concentric with the cutters are the suction pipes, carrying an adjustable mouth of suction end which terminates about one foot above the bottom face of cutter. The arrangement of suction pipes and cutters is seen to form two distinct ladders, supported one on either side of hull and approaching each other at the bow. Here the adjoining suction pipes are bolted together through the medium of a cast distance

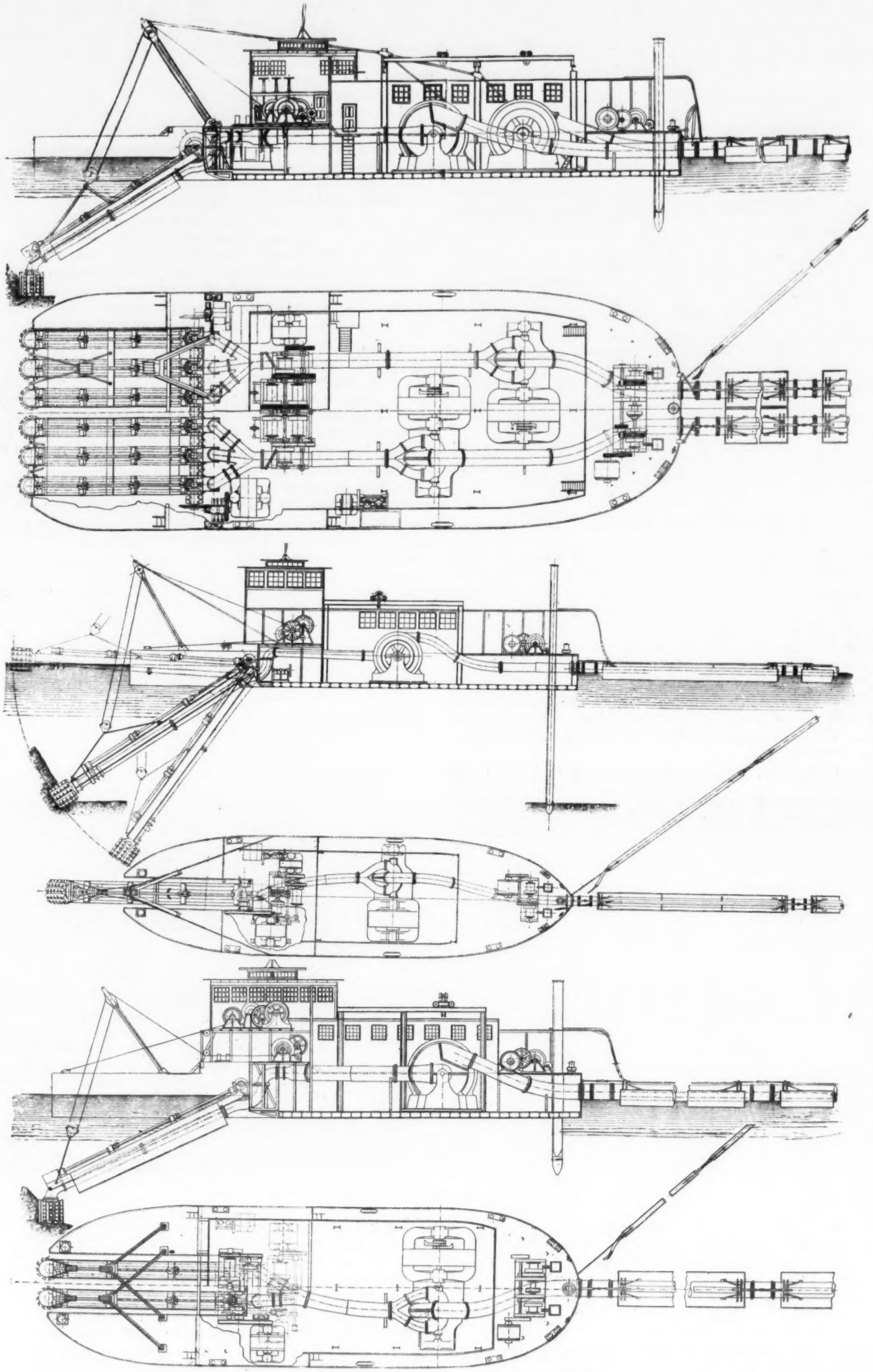


Fig. 6.—Elevation, Plans and Sections of Dredges.

piece, giving solidity to the whole. When the cutters are down in normal working position, they may work backwards as well as forwards, taking a face the full depth of the cutter. The greater part of the weight of cutters and suction pipes is carried by the two hoist-

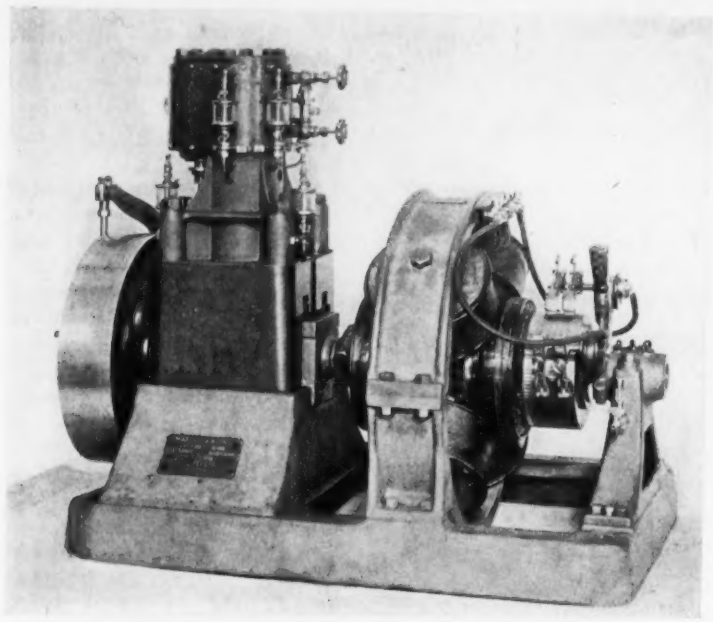


FIG. 7.—15-KW MARINE SET.

ing cables, through sheave blocks and sheave legs to the hoisting drums, by which the depth of the cutters is regulated. The chief reliance for protecting bearings which are under water is a constant stream of water fed to the centre of each journal at a pressure of about 60 pounds from a special pump on the dredge. Removable sheet iron covers with handholes are placed over all gears which are under water. The ladder pipe throughout is of cast steel, and is supported at the hull by two trunnions, which are carried by strong cast steel bracket bearings. The trunnions are bored out around the centre of rotation to permit the countershaft to pass through the inner one. The shaft has an outward bearing midway between the two trunnion bearings.

The propulsion of the dredge is accomplished entirely by screws driven by electric motors, all other movements being effected by the direct use of steam. The fundamental idea in the installation of the electrical equipment, as indeed of all the machinery, has been that the directing mind in the operating room should have close at hand and always ready for instant use the means to start, stop or modify all the movements of the great machine. To this end the absolute control of the entire electrical apparatus is placed back of and to the right and left of the operator in the form of switches, rheostats, controllers and compensators.

The three-phase system has been adopted for power distribution, and the entire equipment was supplied by the General Electric Company, of New York. In each hull a 600-kw, 550-volt, 24-pole generator is driven by an 800 I. H. P. marine engine, direct connected, running at 200 revolutions, thus giving a frequency of 40 periods per second. The current from this generator is led to four motors on the dredge and to two on the end pontoon. The former are all alike, being rated at 125-hp, having 12 poles and running at 400 revolutions. Each drives directly a four-bladed propeller 46 inches in diameter. Two of these are at the stern, and the other two are in recesses in the sides of the hull, well forward. The pontoon motors are of 30-hp each. They have ten poles and run at 480 revolutions, with their shafts coupled directly to propeller shafts carrying 20-inch three-bladed propellers. All motors are of the induction type. The leads from the generator are attached to the stationary field windings. The larger motors have collector rings and external variable resistance in the armature circuit. The wire forming the resistance for each motor is wound around an insulated 2¼-inch copper pipe 42 feet long, which, in 5-foot lengths, with special fittings at the ends, is carried on a frame. Through this pipe about 15 gallons of water per minute passes by means of a rotary, electrically driven pump, which keeps the temperature within proper limits. The resistance is divided into eight equal parts, and these are thrown into or out of circuit by a controller in the operating room or pilot house, similar to those in use on electric cars. Each of the four motors has its own distinct resistance and controller.

The pontoon motors have a fixed resistance in the armature circuit and their speed is controlled by varying the voltage of the current supplied by means of a compensator—in other words, a form of variable transformer. These two compensators are also in the pilot house.

A separate direct current dynamo is required to excite the fields of the generator. This is an ordinary 15-kw marine set, which also supplies current for a searchlight on the roof and for about sixty 16-cp incandescent lamps which light the dredge. Rheostats are provided in the exciter's field, and also in the field of the generator, so that lamps may be kept steady under varying load on generator.

The design of the pontoons carrying the discharge differs somewhat from any heretofore employed. The displacement is such that when the contained pipe is fully loaded, the draught of the pontoon is not quite two feet. With the exception of the two forming the ends of their respective lines of discharge pipe, all are of uniform construction. Each is 50 feet long from centre to centre of couplings.

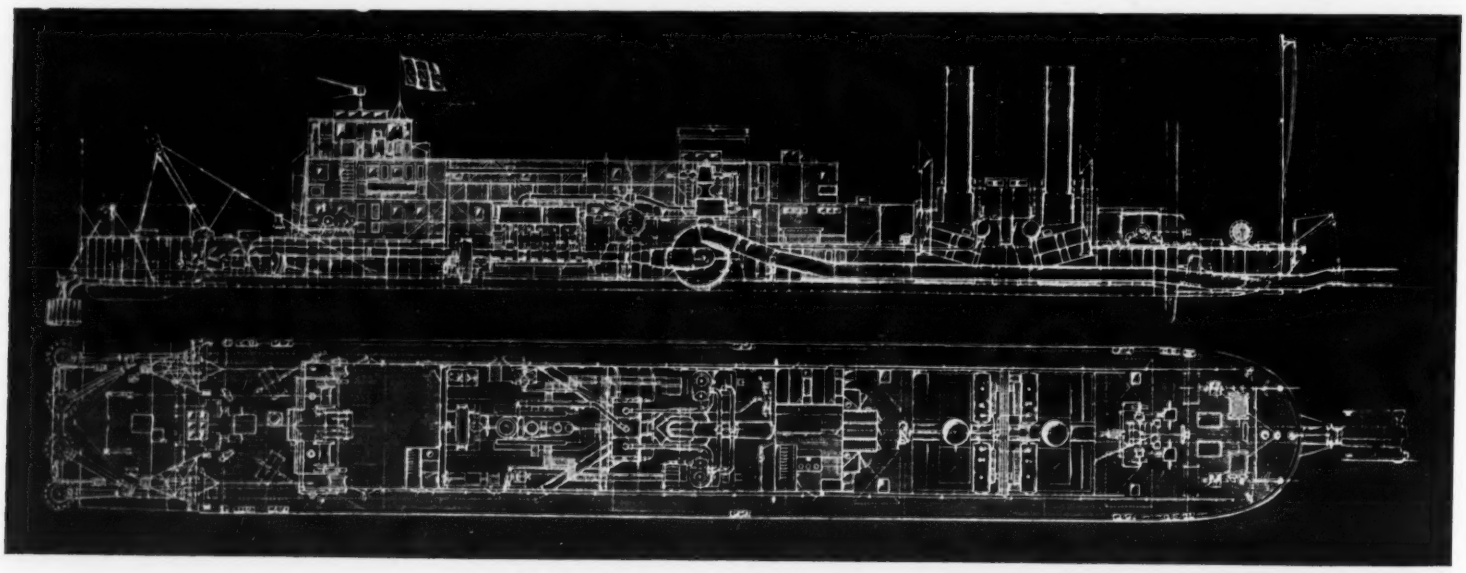


FIG. 8.—ELEVATION AND PLAN OF DREDGE.

The cross-section is elliptical, the horizontal axis of which measures 9 feet 3 inches and the vertical 3 feet 3 inches. Through the centre of the pontoon is placed the discharge pipe, which is 33 inches in diameter. Thus the pontoon proper forms an elliptical jacket for the pipe, whose axis coincides with its own.

To more fully and freely handle the pontoon line when not running, the designer has in addition added a compartment to the end of the last pontoon, in which are installed two 30-hp three-phase induction electric motors, each driving directly a 20-inch screw pro-

peller, and obtaining current from the dredge. These are controlled by the operator in the pilot house, and with the adjustable baffle-plate device give great freedom of movement.

In addition to the large amount of machinery on each dredge half, accommodations are provided for seventeen officers and men, above and below the main deck, with the appropriate galley and ward rooms. A blacksmith forge, with necessary tools and facilities for light repairs, is also provided. To give greater scope to these departments, a stern-wheel boat 125 feet long by 26 foot beam, and drawing but 2½ feet of water, has been added to the equipment. On this are provided handsome quarters for officers, and bunks for ten men, with culinary arrangements complete. On the main deck is a small machine shop, with lathe, drill press and shaper driven by a small upright engine. Electric lights, with a searchlight on the pilot house, are provided. The main engine is compound and indicates 200-hp. This boat is to act as tender to the dredge, and carries near the bow a boom derrick and pump for placing the steel water-jet piles, which serve as anchors for the attachment of the headlines, when the dredge is in operation. These piles weigh about 3000 pounds each, are 30 feet long, and have proven very satisfactory.

An oil barge to carry fuel completes the list. It is of ordinary construction, carries six tanks of a total capacity of 130 tons, and is 80 feet long by 20-foot beam. The loaded draught is 4 feet.

All parts of the dredge were subjected to searching trials prior to the departure of the plant for St. Petersburg. At the termination of the trials it was officially considered that each half of the dredge would be conservatively rated as having an hourly capacity of 2700 cubic meters, or about 3500 cubic yards; a total for the whole plant of 7000 cubic yards per hour. It was also demonstrated that working on a crossover bar, with a current velocity of three to four knots per hour, the dredge could be manœuvred with facility with but one line ahead, thus doing away with half a dozen lines heretofore necessary for holding and manœuvring. As the machine is self-propelling and self-controlling in the current, the electric features manifestly have added enormously to the effective use of the dredge, and have minimized all possible interference with or from commerce.

Electrical Plants in the Sandwich Islands.

That the white population of the Sandwich Islands forms a progressive community is well known to those who have had the pleasure of visiting those beautiful islands in the South Sea, and it is therefore not surprising that they have taken advantage of the benefits of electricity. At present there are three public electrical plants on the islands, two of which are in Honolulu on the Island of Oahu, and the third at Hilo on the Island of Hawaii. One of the Honolulu plants is owned by the government and used for street lighting. This plant is operated by water power and supplies about 125 arcs and 1000 incandescent lamps. Pelton water wheels are used and the generating machinery consists of G. E. series arcs and Westinghouse alternators. During the present summer the plant has been crippled for lack of water due to an abnormally dry season, and at times sufficient power was not generated to keep the street lights in operation.

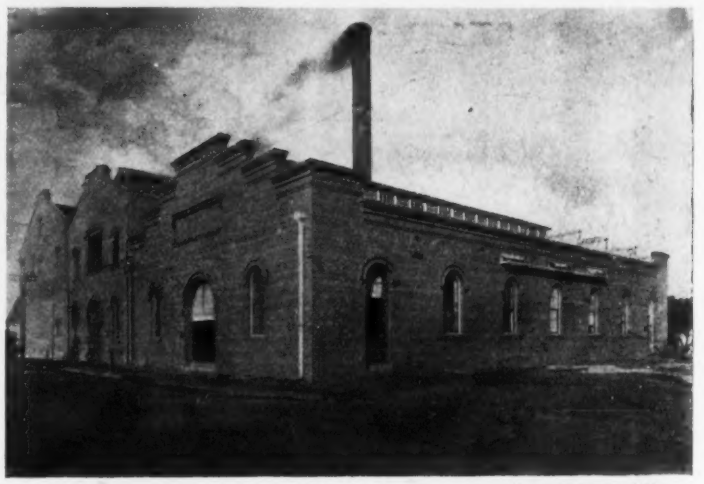


FIG. 1.—BUILDINGS OF HAWAIIAN ELECTRIC COMPANY.

The plant of the Hawaiian Electric Company, Limited, has an exclusive franchise for furnishing electric current for light and power in the City of Honolulu. It has also several lines extending to plantations in the vicinity to which current is also supplied for light and power. The plant has an added interest for the reason that in connection with it is a department for the manufacture of ice and for cold storage, which utilizes the steam equipment during the hours of the day.

The steam plant consists of three 300-hp Heine boilers, two compound Ball engines of 175 and 225-hp respectively, and a 500-hp marine-type compound engine with a rope transmission drive, the

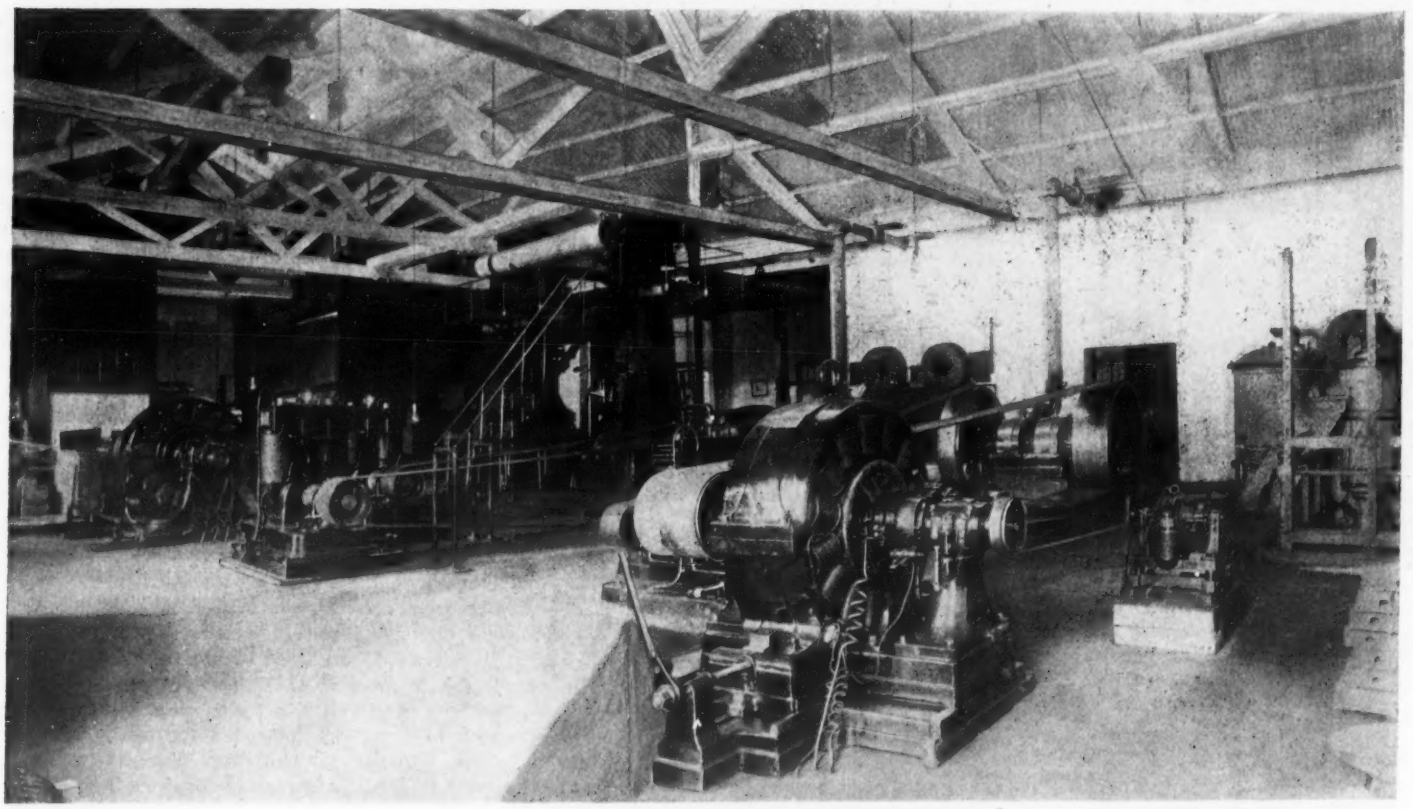


FIG. 2.—GENERATING PLANT, HAWAIIAN ELECTRIC COMPANY.

engine having been supplied by the Philadelphia Engineering Works.

The electrical generating plant consists of one 250-kw Westinghouse two-phase generator, one 120-kw single-phase General Electric generator, two 45-kw Edison type generators and one 120-kw General Electric multipolar generator. At present there is current supplied for about 12,000 incandescent lamps and also for about 200-hp of electric motors used for various purposes.

There is no gas in Honolulu, so that the Hawaiian Electric Company supplies all the illumination where oil is not used. Most of the business houses in the city close at 5 p. m. except on Saturday, when the retail establishments keep open till 10. The company has therefore to depend for its business practically entirely on dwelling house lighting. Though thus limited, the business is prosperous, as may be judged from the fact that the company pays 15 per cent. dividends on its stock. The meter rate charged for current is 25 cents per kw-hour, with a discount ranging from 5 per cent. on bills of $10 per month, to 25 per cent. for bills of $100 or more per month. Some customers are still supplied at the old flat rates, which are $1.25 a month for all-night lights and $1 per month for 11-o'clock lights.

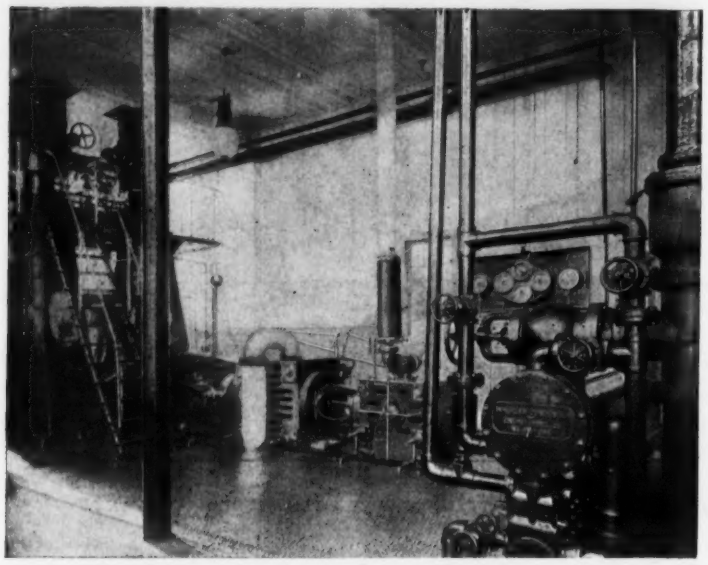


FIG. 3.—ICE PLANT, HAWAIIAN ELECTRIC COMPANY.

FIG. 4.—STATION OF HILO ELECTRIC COMPANY.

The flat rate for dwelling houses is 90 cents per month each for the first five lights and 65 cents for all additional lamps. Coal costs about $7 per ton delivered in the fire room.

The accompanying illustrations give a view of the exterior of the buildings and two views of the interior, the latter showing the electrical and ice-making machinery.

The ice and electric plants have been found to work together very satisfactorily. There is no other concern making ice on the Island of Oahu, and the entire output of the plant is sold to the Peoples Ice Company at $6 per ton.

The population of Hilo, on the Island of Hawaii, is 3500. The plant of the Hilo Electric Light Company, Ltd., was built in 1894, and uses the General Electric monocyclic system, the voltage being 1040 and the frequency 60 cycles. The generator is rated at 150-kw, and at present is carrying a night load of 3000 16-cp lamps and a day load of 210-hp in induction motors. The plant is now overloaded, and an extension is to be begun at once, when a new 300-kw machine will be installed. It is interesting to note that the present plant has now been in operation for 21 months, 23 hours per day, without the slightest interruption of service. The machinery is run by a 6-foot Pelton wheel under a head of 267 feet, the pipe line being 3500 feet long. To run the new plant a fall having a head of 1060 feet is being developed, the water to be led through a pipe line 1700 feet long.

The meter rate charged by the Hilo Electric Light Company is 15 cents per kw-hour. The flat rate is, for single lights, 80 cents per month; 2 to 10 lights, 60 cents each per month; 10 to 19 lights 55 cents, and 20 lights and over 50 cents, the customer paying for all renewals. Power is furnished at the rate of $8 per month for 2-hp; $15 per month for 5-hp; and $2.50 per hp per month for 10-hp and upwards. The rates for series arcs, of which 18 are in use, is $8 per month. Sixty-eight series 32-cp incandescent lamps are also used for street lighting, the rate charged being $1.20 each per month.

Fig. 4 is a view of the Hilo generating station and Fig. 5 a view of the interior.

We are indebted for the information contained herein to Mr. W. J. Johnston, and to Mr. Theodore Hoffman, manager of the Hawaiian Electric Company, and Mr. L. J. Grant, late manager of the Hilo Electric Light Company, and at present manager of the recently formed Automobile Company, of Honolulu. This latter company has just been organized, and is building a power plant which will have two 100-hp Root boilers and two McIntosh & Seymour engines, the latter direct-connected to two 60-kw shunt-wound General Electric 110-volt generators. A preliminary order for four passenger electric vehicles has been placed with the Fischer Equipment Company, of Chicago. The automobile plant is to be in operation by February, 1900.

Export of Electrical Goods to the Far East.

BY PROFESSOR F. B. CROCKER.

HAVING just returned from a trip around the world by way of Japan, China, the Philippines and India, the writer has been asked to give his impressions concerning our electrical commerce with those countries. The eyes of Americans have been turned anxiously in that direction for a year and a half, and a faint appreciation of the commercial importance of the Pacific is dawning upon us. But up to the present our attention has been given chiefly to naval, military and political affairs, business questions being left in abeyance, so that our knowledge of and interest in "The Eastern Question" are still insignificant compared with its great importance and are far inferior to the corresponding ideas of Englishmen on that subject. The fact is that the United States have a better opportunity to extend their trade in that portion of the globe than any other country, even including England and Germany. This is partly because we are much nearer by sea than those countries are to China, Japan and the Philippines, and partly because we already export large quantities of electrical apparatus to England, hence we are in a very advantageous position when we compete with her in a market foreign to both.

The world has only begun to realize this fact. Americans themselves, as a people, have not yet formed anything like an adequate conception of our opportunities. Our Oriental customers were waked up to the fact that the United States is a great power by the guns of Dewey's fleet in Manila Bay. From what the writer heard in almost every place that he visited, the Spanish and Philippine wars are well worth all they have or are likely to cost in men and money, simply on account of their effect on the opinion of the world, leaving aside any acquisition of territory.

Even when we Americans believe that we are entitled to a large share of Oriental trade, and that we can carry it on as well as or better than other countries, it still remains to convince the people to whom we sell, that such is the case. What are the principal arguments in support of this proposition?

It has been pointed out that geographical position is very favorable to this country in comparison with England and Germany.

The distance from San Francisco to Yokohama, Manila or Hong Kong, is between 5000 and 6000 miles, while from these Oriental cities to London or Hamburg by sea is at least twice as far. The Japanese almost always travel to Europe by way of the United States or Canada, because it is a much quicker and cheaper trip. Heretofore the apparent distance and time from China or the Philippines to America has been greatly increased by the necessity of going by way of Hong Kong, Shanghai, Nagasaki, Kobe and Yokohama, this being the regular route of the steamship lines. A direct line from Hong Kong via Manila, Guam, Honolulu to San Franicsco is nearly a straight course and very much shorter than the distance to Northern Europe by way of Singapore, Suez and Gibraltar. A large fraction of the passengers and mail from China to England and the Continent are now carried via North America, and when the more direct route is developed, nearly all will go that way. Indeed, the inevitable improvement of transportation facilities upon the Pacific will have the remarkable effect of transferring the Far East to the Far West, not only from the American standpoint, but from the European as well. This brings out rather forcibly the great advantage of the United States in closer commercial relations with China and Japan.

Another claim that we can fairly make to foreign buyers of electrical apparatus is that we lead the world in the quantity and quality of our product. This is certainly true if we tke all classes of electrical goods together, and is probably true even if a single class be considered by itself, such as electric railway, lighting or power transmission, telegraph or telephone apparatus. This truth is generally recognized by the Japanese, who are a very wideawake nation, having close relations with this country; but in China and India, where English influence is much stronger than American, the assumption is often made that England must be the best place to obtain almost anything, including electrical goods. In several Chinese and Indian cities visited by the writer, electrical plants were being installed or had been contracted for employing English machinery. When England was reached a few weeks later, it was interesting to observe that at many important installations were being made with American apparatus. It is evident that the superiority of the United States in electrical manufactures is not yet recognized in these very conservative countries. This was also shown in conversation with engineers and users of electrical apparatus in China and India. They have a vague idea that the "States" were pretty far advanced in applying electricity to various purposes, but they lacked definite information of what we are doing and how we do it. For example, they still look upon the American trolley system as a new and dangerous experiment. They would be greatly enlightened by careful and continued perusal of the American electrical journals. Every copy of the ELECTRICAL WORLD AND ENGINEER sent to those countries is a sort of missionry tract.

Beyond question those countries are on the eve of great development in electrical applications. Electric railways will certainly be introduced very widely. The Oriental is exceedingly fond of traveling, as shown by the crowds of natives upon Indian and Japanese railways and the fact that these railways are financially successful. Electric power transmission systems will also be installed in many places. Water power is quite abundant in Japan, China and certain parts of India, and is destined to play an important part in the opening up of these countries. Electric lighting plants are just beginning to be put in. For example, the first central station in Calcutta was erected during the present year, although that city is the metropolis of India with nearly a million inhabitants. There are few places in the world where the electric light is more desirable, the climate being excessively hot during the greater part of the year For the same reason, the need for electric fans is as great as in any other city upon the face of the globe. This statement is made from personal experience, and applies to practically all Oriental and tropical regions.

The use of the telegraph and telephone will also extend rapidly in the Orient, the very natural laziness of dwellers in hot countries acting as a powerful influence to make popular anything which substitutes sitting in place of walking. So far as India is concerned, the government telegraph system is so fine that she has little to learn from us in that direction. In fact her iron pole line construction might well serve as a model for all the rest of the world. But perhaps she could obtain with advantage from this country supplies and instruments made according to her own excellent specifications.

This brings up the point which is undoubtedly the most serious obstacle to the development of American export trade. It is our failure to cater to the wishes and customs of the foreign buyers of our goods. At home all that is necessary is to make a good article well adapted to its purpose, and the purchaser is generally satisfied to take it. If it is different from what he is accustomed to, so much the better, since he will probably consider it an improvement. The annual purchase of a new bicycle with slightly different diameter of tubing illustrates this national tendency. On the contrary, the foreigner, especially the Oriental, is intensely conservative, with deeply rooted ideas concerning the sizes, shapes and even colors of articles that he wants. It is essential to conform to his notions even though they may be founded upon nothing but ignorance or prejudice. Some colors may be highly popular and others tabooed. The way that goods are packed makes a great difference in their marketability. The writer has heard complaints of our independence in this matter all over the world—in Europe and the West Indies as well as in the Eastern countries. The Germans avoid this mistake by humoring the whims of their customers, and thereby get ahead of our countrymen in very many cases.

The proverbial quickness of Americans should soon bring them to an appreciation of this point after a little more experience in exporting manufactured articles, their trade being confined heretofore to food products and raw materials for the most part. Their natural shrewdness will then make them endeavor to accommodate the wishes of their patrons in every possible way, thus securing a mutually satisfactory condition of affairs.

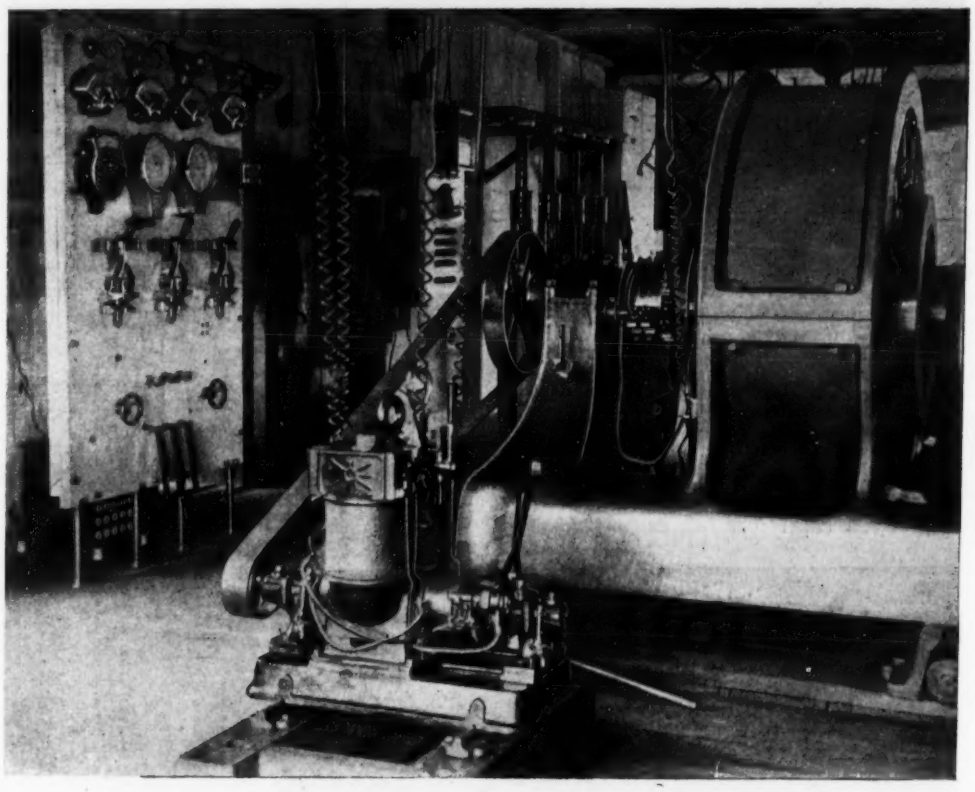


FIG. 5.—GENERATOR AND SWITCHBOARD, HILO ELECTRIC COMPANY. (See page 522.)

Licensing Automobiles in Philadelphia.

The question of licensing automobiles having arisen in Philadelphia, the City Solicitor has filed an opinion that only vehicles used for hire can be taxed as proposed, with a fee of $10 a year. It is likely that permission will shortly be granted to run automobiles in Fairmount Park.

An American Electric Power Plant at the Frodingham Steel and Iron Works, England.

THE Frodingham Steel & Iron Works, Lincolnshire, England, determined about two years ago to introduce electrical practice in their works. The Westinghouse Electric & Manufacturing Company received a contract to supply a 150-kw direct-current generator, 250 volts, with compound wound fields, and the plant is now in full and successful operation. Fig. 1 shows the generator operated by a rope drive from the steam engine. The design of this multipolar direct-current machine is characterized by a circular yoke, into which are solidly cast the pole-pieces of laminated steel. The frames are divided in a horizontal plane, the bearing stands being integral with the lower casting. Improved self-oiling, self-aligning ball-and-socket bearings are used. Machine wound coils are adopted, as practical experience has demonstrated that they are capable of much better mechanical construction, and may be maintained at a much higher state of permanent insulation than it is possible to obtain with any method of hand winding. The armature cores are constructed of punched discs of special sheet steel carefully annealed before assembling. Longitudinal openings permit free passage of air through the core, and ventilation is further augmented by ducts perpendicular to the axis of the core. Every coil is continuous throughout its length, with no joints except where it connects with the commutator. The method of winding employed is such that free circulation of air is permitted to cross the ends of the core through the coils.

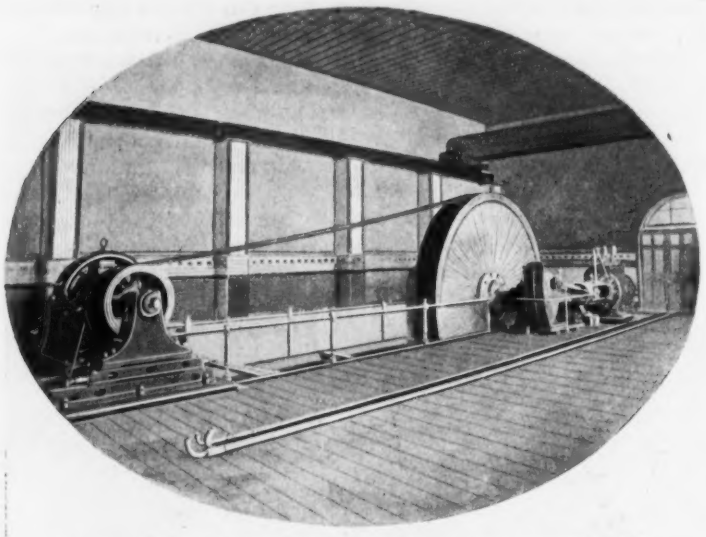


FIG. 1.—DIRECT CURRENT GENERATING PLANT; FRODINGHAM.

The current from the generator is used to operate direct-current motors. Three 50-hp motors serve to drive conveying roll tables, for carrying the finished or partly finished product to and from the different parts of the mill, and also for bringing pieces of metal to the saw to be cut into required lengths. Two 50-hp motors drive the skids which transfer blooms from one table to another. One of these motors in a dustproof cover is shown in Fig. 2. The controlling apparatus is seen in the upper part of the illustration upon a platform. The motors drive by worm and gear, the worm and gear are enclosed in a case so that they may be run in oil, this case being fixed upon the same bed plate as the motor. The worm shaft and the motor shaft are connected by an ordinary flange coupling.

Two motors of 35-hp each are mounted upon the charging machine, seen in Fig. 3, which travels back and forth in front of a number of reheating furnaces. The charging machine receives the blooms from the conveying roll tables, and feeds them into the reheating furnaces by means of a short set of rolls (similar to those on the roll feed tables), and by a traveling finger which finally pushes the blooms into the furnaces. This charging machine is carried by a heavy four-wheeled truck. One of the motors is geared to the axle of the truck, and used for moving it back and forth in front of the furnaces.

The other 35-hp motor is used for driving the set of rollers on the charging machine and the traveling finger, an arrangement of clutches being used whereby the shaft which the motor drives may be connected either to the rolls or to the finger, or to both. All these motors are subjected to very trying conditions, as their employment necessitates their being constantly stopped, reversed and restarted.

The controllers used are of the type employed where frequent stops and reversals are required; a class of service which requires

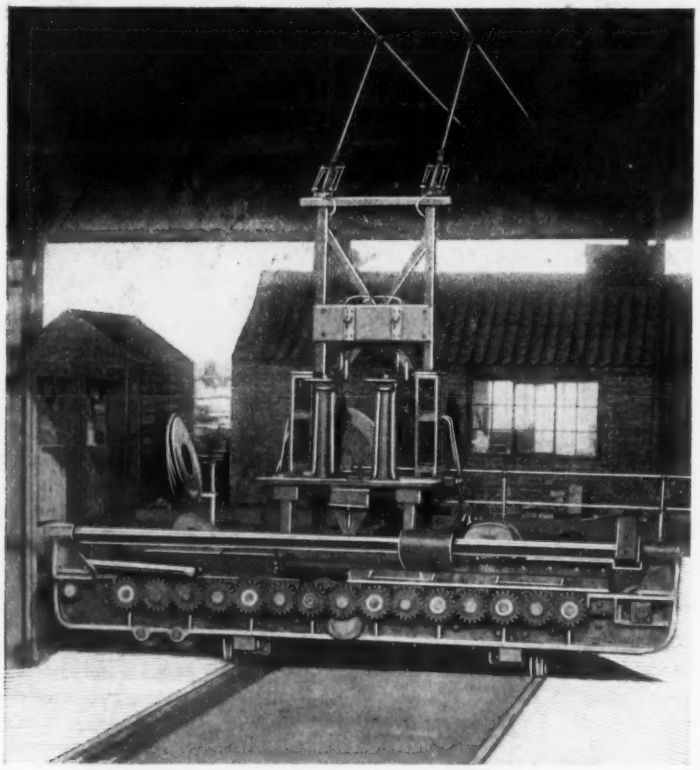


FIG. 3.—35-HP MOTOR OPERATING A CHARGING MACHINE.

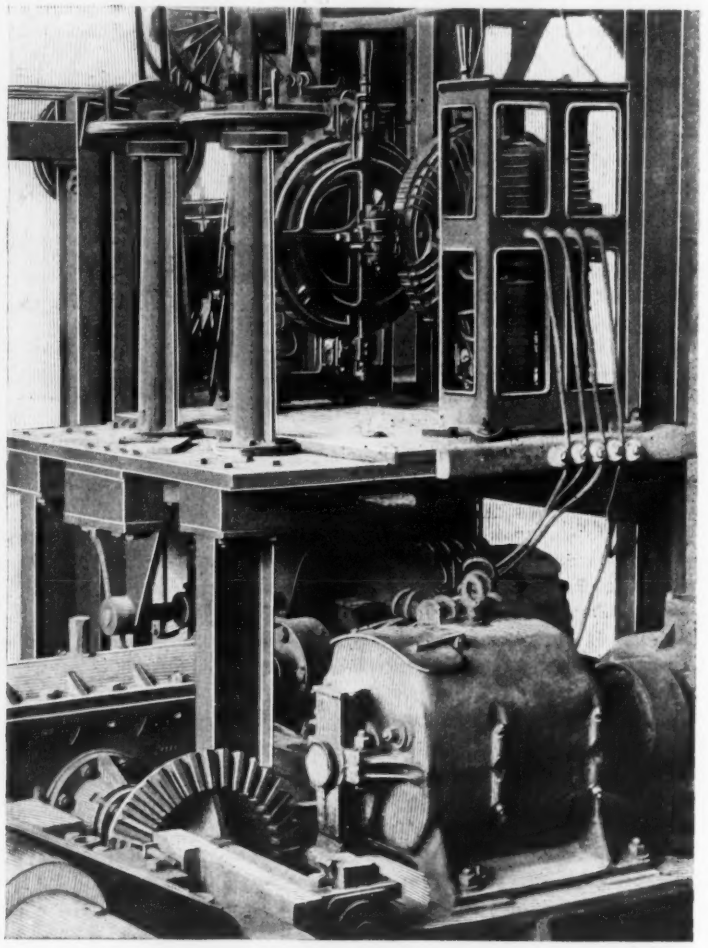


FIG. 2.—50-HP MOTOR, DUSTPROOF.

very substantial and well-built apparatus. The controllers consist of an iron box containing the necessary resistances, a commutator composed of a number of contact blocks, each of which is connected to the resistance at a suitable point, and a set of brushes mounted upon a rocker arm. Varying amounts of the resistances are induced in series with the armature circuit by moving the controller handle. The direction of rotation of the motor depends upon the direction in which the controller handle is moved, the direction of the current through the armature being thereby determined. These controllers have a large number of resistance steps, giving very close regulation and little arcing. The circuit is opened with four breaks in series. The break contacts on which the circuit is opened are provided with removable tips, which may be renewed.

Although electrical apparatus is considered standard practice in American steel and iron mills, it has not yet been widely adopted in England. It is therefore interesting to chronicle the installation of the Frodingham Steel & Iron Works, and to await the irresistible advance of electric power in this field there, as in the United States.

Electricity for Sanitation at Havana.

THE use of electrolyzed salt water for purposes of sanitation and disinfection has become more or less familiar during the last few years, chiefly in this country through the work of Mr. A. E. Woolf, of New York City, who, convinced that chemical methods of obtaining the hypochlorites could not compete with electrical in the production in large quantities, has devoted his energies to the

FIG. 1.—PLANT FOR ELECTROLYZING SALT WATER, HAVANA.

simplification and perfection of the electrical system. In 1893, the attention of New York was called by the cholera plague in Hamburg to the poor condition of its drinking water, and Mr. Woolf put in a dynamo plant for generating current at Brewster, N. Y., where the purifying liquid was sprayed into the streams and marshes. In 1894, on a much larger scale, Mr. Woolf, at Riker's Island, purified an immense deposit of city refuse, with four electrolyzing vats and a steam plant of 100-hp. A year or two ago the method attracted the attention of the municipal authorities in Philadelphia, who had heard of the use of the liquid for cleansing some of the northern cities in France, and a plant was installed which is doing excellent work in the sanitation of some of the slums, the Chinese district, etc.

When the American authorities succeeded the Spanish in Havana, Cuba, at the beginning of this year, their greatest difficulty lay in cleansing that beautiful city, long infamous as one of the worst pestholes in the world, and the seat of yellow fever, which, spreading thence, has more than once devastated our Southern states and the whole Atlantic seaboard. It was realized that mere brooms and buckets would not suffice, but that recourse must be had to the best methods on the largest possible scale.

As a solution to part of the problem for the sanitation of Havana, the military governor of that city upon the report of the board of experts, decided to install a plant employing the Woolf electrical process for the production of hypochlorites from sea water, the product, known by the trade name of "electrozone," to be used for the disinfection of first, the streets and sewage system, and then the harbor. This work was placed in the hands of Major J. G. Davis, chief of the snaitary division, and in February last he placed in operation a small plant on which tests were made. From the results obtained he recommended that a plant be installed with a daily capacity of 100,000 gallons, which recommendation was adopted.

The plant is in a building in Fort Cuba, foot of Cuba street (Fig. 1), which was thoroughly remodeled for the purpose. A battery of four boilers and two Ames engines of 250-hp furnish the mo-

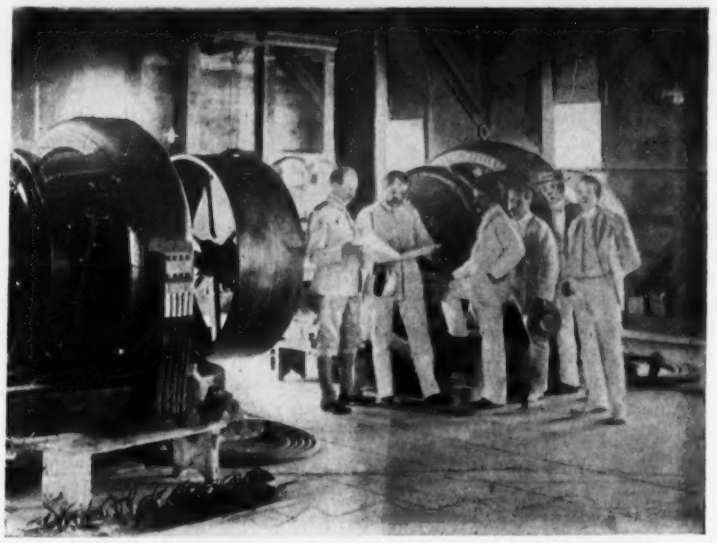


FIG. 2.—GENERATING PLANT.

tive power. The engines are belted to a countershaft running the full length of the building, from which shaft there are at present operated four Crocker-Wheeler dynamos of 100-kw each (Fig. 2), each dynamo supplying 4500 amperes at 12 volts. Each dynamo is connected with its own switchboard and thus the operator is able to regulate separately the current from each machine. The machines are separately excited by an 18-kw exciter.

There are eight electrolyzing vats into which sea water is pumped from the bay, one of which is shown in Fig. 3. In each vat are 417 positive electrodes and 425 negative zinc electrodes. The current is 6 volts per vat, the vats being run two in series. The positive electrode being the one subject to attack from the gases evolved, is formed from an alloy of platinum and iridium, which material is not acted upon by nascent chlorine. This electrode is immersed at a distance of about a half inch from the negative electrode. In the process of electrolysis, the positive elements resulting from the decomposition of the sea water gather at the negative electrode and the negative elements at the positive electrode. Thus oxygen and chlorine appear at one electrode and hydrogen collects at the negative electrode, whence it rises to the surface and escapes into the air. The chlorine and oxygen at the positive pole unite with the bases, forming hypochlorites, which have long been recognized as most powerful disinfecting agents. The solution thus contains the hypochlor-

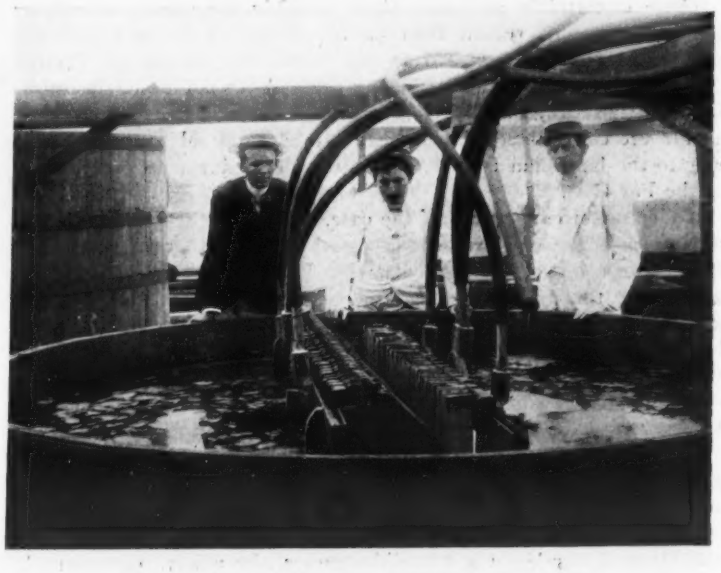


FIG. 3.—ONE OF THE VATS, SHOWING ELECTRODES.

ites of sodium, magnesium, potassium and calcium and traces of bromine and iodine. The first-mentioned compounds are so unstable

that the instant they come into contact with organic matter, such as germs, bacteria, etc., they are immediately split up, and the chlorine, on account of its great affinity for hydrogen, unites with the hydrogen contained in the organism, nascent oxygen is liberated and exerts a destructive disinfecting action. The sewers and unpaved portions of Havana have already been treated and as fast as disinfectant can be manufactured it will be put to other effective uses. The capacity of the present plant is 160,000 gallons every 24 hours without crowding, the strength of the product being 90 grains of available chlorine to the gallon.

The results may best be learned from the reports of the military authorities which were reviewed recently in the New York papers, and which led the *Evening Post* to say: "The great value of a thorough and persistent cleansing of accessible surfaces has been demonstrated, and has a hundred times paid for the cost of the experiment. That the street-broom and the disinfecting spray alone should have reduced the Havana death rate to about the normal for a city of its size in the temperate zone, and kept down yellow fever actually below what it has been in Key West, so that Havana is proudly quarantining against American and Mexican gulf ports—this is the great sanitary feat which cannot overcome us like a summer cloud without our special wonder. As a simple matter of fact, Havana has actually been quarantining against New York and is healthier than ever before in her history. Making the comparison with the normal years 1890-95, we find the general death rate lowered, and, in particular, the deaths from yellow fever, brought to a smaller figure than in any given period of the same length since official records were kept. Up to September 1 there had been only twenty deaths from yellow fever, as against a yearly average of nearly 400 from 1890 to 1895. And so prompt and sure had been the process of isolation that not one case of the fever was known to have come by direct infection. Only three deaths from this disease had occurred among the 3000 American soldiers; the Spanish troops had lost thousands, by pure neglect, as is now evident."

It would appear that in tropical climates, the liberal supply of electrolyzed sea or salt water, obtained with the aid of a small dynamo run by steam or water power, will be a powerful reinforcement of existing sanitary agencies and create in turn another field for the widespread use of electrical apparatus.

The Market in the Far East for American Goods.

BY W. J. JOHNSTON.

AT the present time I know of no subject of keener interest to an intelligent American—in or out of the electrical business—than the vigorous strides the country is making in the growth and development of its foreign commerce. Manufacturers, dealers, shipowners and others naturally take a distinct personal interest in the matter, while the rest of us feel at least a patriotic pride in the upbuilding of the nation's carrying trade, as it is eminently right and proper that we should.

There is certainly no better place to study the rapidly changing conditions in this regard than on board one of the new line of steamers recently established to ply to and fro across the Pacific Ocean, in response to the increasing demand for additional facilities for the transportation of American machinery and the like, as well as for the conveyance of American tourists and salesmen on their way to the Hawaiian Islands, Japan, the Philippines and other parts of the Far East.

Under the circumstances of the case, I chose for the first stage of my journey around the world a vessel sailing under the Japanese flag, because I felt that on such a ship I would come into prompter and closer touch with peoples and civilizations with which I was anxious to become acquainted. The Hong Kong Maru, on which I left San Francisco, is the latest to be launched of three handsome and modern English-built, twin-screw, 6000-ton steamers belonging to the Toyo Kisen Kaisha (which is Japanese for Oriental Steamship Company). "Maru" is a part of the name of every merchant steamer in Japan, to distinguish it from a warship. The captain, first officer, chief engineer, purser, doctor and chief steward of each of these vessels are either English or American. The sailors are principally Japanese, and the cooks, stewards, etc., Chinamen. I found the Hong Kong Maru a splendid steamer, the officers experienced, capable and delightfully social; the Japs good sailors, and the Chinamen ideal servants. The Chinaman rarely shows emotion of any kind, and never argues or offers excuses. He is quick to appreciate and even anticipate your wishes, and having once learned them, never forgets.

Few of us, even in New York, can readily tell the difference between a Japanese and a Chinaman, especially when we see them apart. The voyage from San Francisco to Honolulu takes only six days, but that is quite sufficient on such a ship to realize that Chinamen and Japanese are as different in appearance and in manners and customs as are, for example, the Germans and the French, or the Scandinavians and the English. Looked at from the commercial standpoint, the Chinaman, though he is not so progressive or so prone to inaugurate changes as is his Japanese neighbor, has proven himself in general trustworthy, honest and exact in his business dealings, and his credit at home and abroad stands high. The Japanese, on the other hand, are excitable and, particularly since the war, independent, and do not make good servants. For my own part, I have always liked the Japanese, because of the many charming gentlemen of that nationality I have met in America, attending our electrical conventions, or taking courses in some of the electrical manufacturing establishments of the United States. It pains me, therefore, to add that, while the Japanese crave the very latest in design and practice of electrical and other appliances, I am told they lack, as a rule, the sterling commercial qualities of the Chinaman.

Readers of the ELECTRICAL WORLD AND ENGINEER who may be interested in the trade of Japan and China, and anxious to secure a share of it, may be interested in these differences between the two nations. Steamers and sailing vessels leave San Francisco, Portland, Seattle or Vancouver for the Orient almost daily, yet even the recently increased facilities are taxed to the utmost to move the large quantities of American machinery which finds a market in the Hawaiian Islands, Japan, China and the Far East. Every available inch of space in the Hong Kong Maru was taken up by freight, some of which, I was glad to learn, consisted of electrical equipment and supplies shipped by well-known American manufacturers and dealers. On the deck were huge boilers, bearing the tag of a well-known machinery house in Liberty Street, New York. The boilers were going to China as part of the equipment of a new railway there. In fact, so crowded was the ship with freight that part of the deck for a few days out was covered with sacks of coal for use on the voyage.

It is only after one has made such a trip as this that he begins to adequately realize the extent and promise of the foreign trade of the United States, and how largely electrical machinery and appliances enter into this. The Hawaiian Islands will naturally continue to buy from the United States, practically if not absolutely, all the machinery they will need, and the future of these islands never seemed brighter than at the present time.

HONOLULU, HAWAIIAN ISLANDS.

The Commercial Congress at Philadelphia.

Director General Wilson, of the National Export Exposition, has made the announcement that the date for the opening of the International Commercial Congress had been definitely fixed as Oct. 12, instead of Oct. 10, as heretofore stated. It is expected that a large number of prominent Americans will attend the sessions of the Congress and deliver papers upon important topics. Some of these are ex-President Harrison, Senator Chauncey Depew, Hon. John Kasson, Gov. Theodore Roosevelt, ex-Senator George F. Edmunds, Postmaster General Charles Emory Smith, Gov. William A. Stone, Gen. James W. Hawley, Congressman Grosvenor, Gov. Atkinson, of West Virginia; Hon. Joseph Dyer, the financial expert, and others. Some of the subjects which are to be taken up in the early days of the Congress are as follows: International arbitration from a commercial standpoint, the revival of the American merchant marine, advantages of an extension of international parcels post facilities, the advantages to all nations of an isthmian canal, international banking, the future of Cuba, value of Puerto Rico, dominant position of the United States in the West Indies, application of the Monroe doctrine to American Republics, an "open door" policy in China, Australian federation and its commercial outcome, Great Britain and the Transvaal, and, the commercial outlook for the coming century. The proceedings of the Congress will be conducted uniformly in English, but any modern language may be used by speakers in debate.

Thirty-seven Governments have named official envoys to the Congress and two more, Bolivia and Cape Colony, are expected to take part. More than 200 Chambers of Commerce and other trade bodies throughout the world have named delegates to attend the Congress.

Crocker-Wheeler Smelting Generators in England.

WE show in the accompanying illustration a type of generator recently built by the Crocker-Wheeler Company for the Smelting Corporation of Ellesmere Court, England. The capacity of the machines is 400-kw and they run at a speed of 100 r. p. m., the terminal voltage being 250. The magnet frame is of soft cast iron and of girder construction. See Fig. 1. The yoke is a cast iron ring with short internal flanges on each side, which, beside strengthening the ring against breaking, afford considerable protection from mechanical injury to the field coils located between them. This yoke is divided in half horizontally, each half having six cast-in poles.

The poles are round and of cast steel, cast-welded into the yoke, thereby securing a perfect magnetic joint. They are provided with removable cast iron shoes, clamped in place by screws after the field coils have been put on. These shoes increase the surface of the poles exposed to the armature, and therefore reduce the density of the magnetic flux where it enters the armature and permits a long air-gap or clearance between the armature and field to be used. Each pole is excited by a separate field coil wound on a removable spool. The series coil consists of standard copper strips, and is separated from the shunt coil by an insulating fibre washer. The shunt winding is of double cotton covered wire of standard gauge and both shunt and series are wound on in an ordinary lathe. Particular attention was given to the radiating surface of these coils (See Fig. 2) as the English permissible temperature rise is much lower than that of American engineers.

The coils are practically impervious to water, being thoroughly "mummified." Each of the numerous insulation wrappings is thoroughly saturated in an oil varnish and baked after applying the oil. In the construction of such machines, great care is used in the insulation and before leaving the works, it is tested under a direct-current of 1000 volts applied between the copper and the spool.

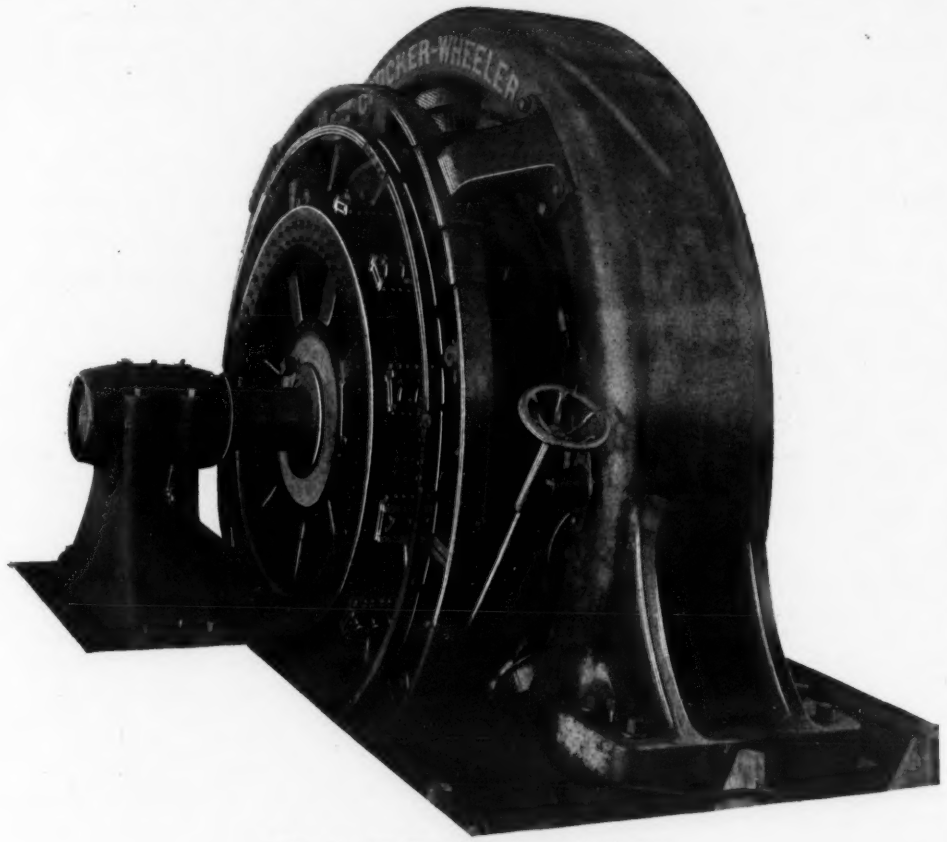


FIG. 1.—400-KW SMELTING GENERATOR.

As the air gap is long, any slight inaccuracy in centreing the armature affects only slightly the total clearance and therefore has but a small effect on the magnet balance of the machine.

The armature has a toothed core which is built up of sheet iron punchings, .022 in thickness, and has several ventilating ducts ½-in. to ¾-in. wide, which allow free circulation of the air. These are formed by the insertion of distance pieces.

The spider arms are so constructed as to give rigid support to the separate laminæ of which the core proper is built up, this doing away with insulated through bolts which are expected to compress the plates with force enough to prevent their slipping under centrifugal force. The laminæ are insulated from each other by a layer of oxide formed during the annealing process, and in addition

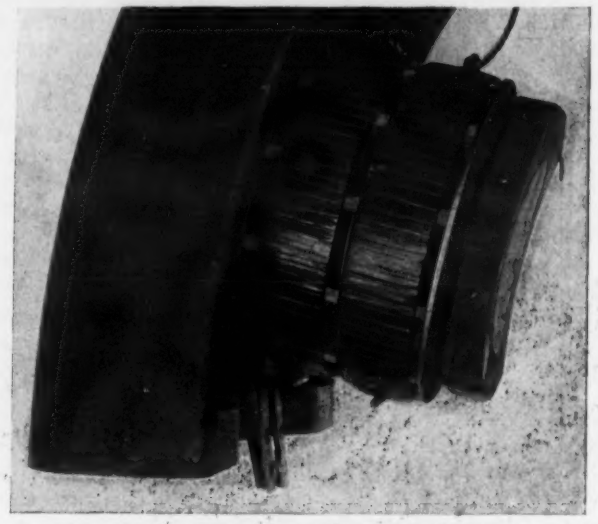


FIG. 2.—SHOWING A POLE WITH ITS FIELD COILS.

by a sheet of paper after each fourth disc. The slots have parallel sides with rounded bottoms and openings at the top the full width of the slot.

The coils are form-wound and bedded in slots lined with insulating materials and micanite; in fact, wherever the coils come in contact with supporting or retaining surfaces mica is liberally used. Each slot contains two coils (See Fig 3) separated from each other by a strip of insulation. Issuing from the bottom of a slot a coil bends only slightly downward, but considerably to one side. It then bends sharply upward and still further to the same side and enters the top of slot about 45° distant from the slot out of the bottom of which it came. The end of the coils are supported by a bell-shaped casting, to which they are tightly bound by binding wire. No crossing conductors are in contact since they pass each other in different planes. With this construction the conductor has no joints, except at at commutator, and removes the possibility of any trouble occurring from loose connections in the armature.

Repairs on the armature are facilitated, as any one of the conductors may be taken out and replaced without disturbing many of the others. This so-called cable winding has the advantage over the bar winding through employing standard wires which are always readily obtainable, whereas the special conducting bars for bar winding require riveting together and can only be obtained from the makers of machine. The insulation is of the highest grade, and is guaranteed to have an insulation resistance of one megohm, and will not break down when subjected to 1000 volts direct current, which is the standard factory test of this make of generator.

The core is mounted on a cast iron spider, which is keyed to the engine shaft. The spider carries a sleeve extension at one end for the support of the commutator. The armature and commutator are therefore a unit, and may be removed from the shaft without disturbing the connection between them.

The commutator is the most costly part of the armature. It is made of pure hard drawn copper with copper tails riveted as well as sweated into the end. These tails are made sufficiently long to keep the soldered joints of the armature conductors cool, even though the commutator bars should become overheated from any cause, and are arranged so as to permit free circulation of air be-

tween them. The commutators on these machines were made up in sections, so that at any time a few bars may be removed without disturbing those which go to make up the balance of the commutator.

The hub which supports the commutator on the sleeve extension

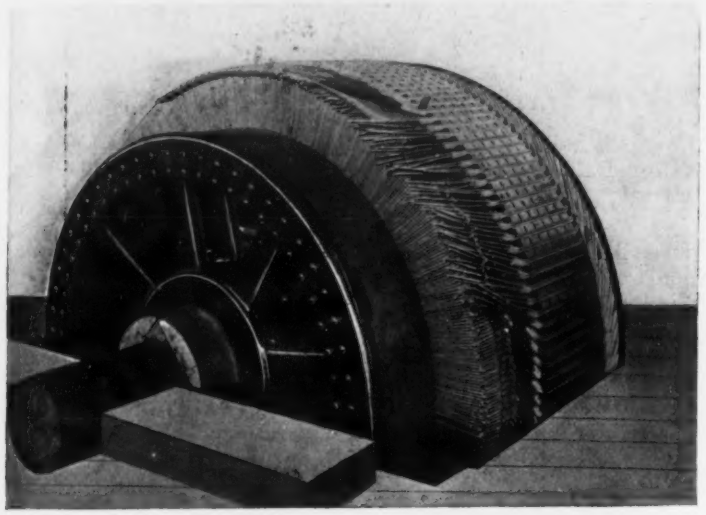


FIG. 3.—ARMATURE IN PROCESS OF WINDING.

of the armature spider has wide spaces between its spokes, permitting the air to pass freely through the armature from end to end.

The brush rigging consists of a circular iron casting made in two parts, and is supported by brackets fastened to the yoke of the machine. This makes it entirely independent of the outboard engine bearing. To this ring, but insulated from it, are fastened various sets of brush-holders. The brush-holders are of the well-known Crocker-Wheeler parallel movement type, as shown in Fig. 4, the brush being clamped firmly in a brass box which moves radially to and from the commutator. The holder is so constructed that it will permit any individual brush to be lifted off the commutator and retained in that position, or even be removed and replaced again without affecting the character of its seat upon the commutator face. The current is conveyed from this to the rocker arm by heavy sheet copper links. The brush is therefore always perpendicular to the

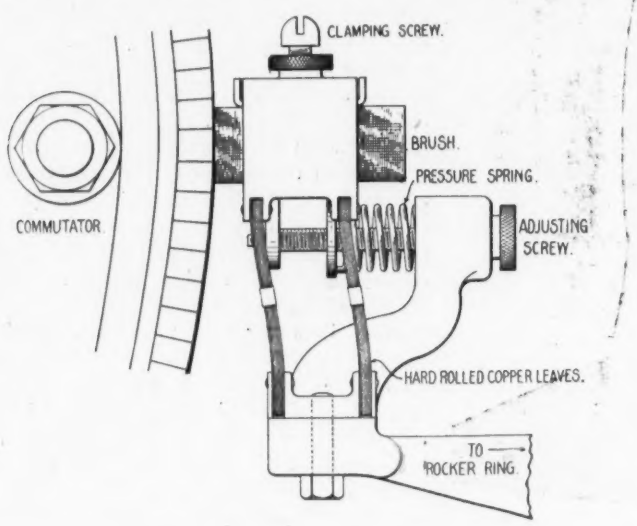


FIG. 4.—BRUSH HOLDER.

surface of the commutator. No spring or sliding contact carries any current. All positive sets of brushes are connected together by a flat copper conducting ring mounted on one side of the rocker ring, and all negative brushes are connected by a similar ring on the other side. The brushes used are of carbon and the current density does not exceed 30 amperes per square inch.

The general dimensions of these machines are as follows: Diameter of armature, 87 inches; diameter of commutator, 67 inches; weight of armature about 13 tons; total weight of each machine about 32 tons.

Electricity in Mexico.

In his recent message to the Mexican Congress President Porfirio Diaz makes the following reference to the Federal telegraph system of that country: "In order to secure communication on the East with the peninsula of Yucatan a three-wire cable measuring 2165 meters in length has been laid at the Alvarado bar. Iron posts have continued to be substituted for wooden posts, the change having been completed for the whole distance between the City of Vera Cruz and Alvarado. On posts belonging to railways, Federal telegraph wire has been strung for an aggregate length of 246 kilometers, and on posts previously established 136 kilometers of multiple wire were erected. Between Altar and Caborca, in Sonora, a new line has been constructed; in the State of Vera Cruz, the Rio Blanco factory has been connected with the Federal system; in Yucatan a commencement has been made in the extension of the line from Ichmul to Valladolid, via Tihosuco, and in the State of Chiapas work has been started in extending the telegraph line of the department of Palenque. As a consequence of this extension of the system, ten new offices have been opened. The volume of business passing over the Federal telegraph lines has continued to increase. In the second half of the last fiscal year the increase was 16.22 per cent. over the first half of the last fiscal year. The earnings for the entire year due to collections in cash, exceeded those of the preceding year by $117,000."

President Diaz also takes occasion to refer in his message to the development of water powers and the establishment of electrical generating plants in the Republic as follows: "The manufacturing industries also give evidence of progress, the following plants which have been erected under concessions from the Federal Government for the utilization of water powers, being especially entitled to mention: The Industrial Company of Vera Cruz erected a dam on the Rio Blanco in order to utilize a volume of water which, under suitable elevation, produces 1500-hp, consumed in the spinning and weaving factory of Santa Rosa inaugurated in May of the present year. The Industrial Company of Orizaba constructed another dam on the Tlilapam river with a race of 1700 meters in length, conveying the water to four turbines connected with dynamos, at an impetus sufficient to develop 2250-hp. The electrical energy thus generated is transmitted along overhead wires to the cotton factory of Rio Blanco. The San Ildefonso Company has completed all of its waterworks on the Monte Alto river, including an aggregate of twenty-five kilometers of races with dams, sluices and other engineering works of importance. Along the Tlan-Tlalnepantla river twenty-five more kilometers of races are about to be completed. These works, with respective electric plants, will produce an effective energy of 5500 steam hp, which will be transmitted to the City of Mexico, for which purpose the line of posts for the transmission cable has been completed and work is in progress upon the receiving station. The above does not include the power that is already utilized in the San Ildefonso woolen factory. In the district of Atlizco, State of Puebla, another company has erected waterworks sufficient to produce 1125-hp, to be utilized in a new spinning and weaving factory. Still another company has completed waterworks on the Cuautitlan river of sufficient importance to produce 810-hp."

Quick Communication with Alaska.

The Canadian Department of Public Works has been advised that the telegraph line from Lake Bennett to Dawson will be completed about Nov. 15. The Canadian Pacific Railway has just about completed arrangements for sending telegraphic messages almost daily from Vancouver to Skagway, at which point the telegraphic connection with Dawson is made. The idea is to have packages of messages sent every other day from Vancouver, and every intermediate day from Victoria and Nanaimo, making as nearly as possible a daily service with the north. At Skagway they will be placed upon the line to Bennett, and at the latter place they will be transmitted to the line which is being built by the Dominion Government, and forwarded to Dawson. By the fastest steamers to Skagway telegrams should have no difficulty at all in getting to Dawson the fourth day after leaving Vancouver. Coming down the same arrangement will be in effect. The steamers will bring messages, and at the first port of call, whether Comox, Nanaimo, Victoria or Vancouver, the messages will be delivered to the telegraph office for transmission to the various points to which they are addressed.

Alternating Generators for Direct Service.

By Alton D. Adams.

ELECTRIC light and power work in this country was inaugurated with direct currents. First came the arc lamp, requiring a constant current and capable of connection in series so as to be operated on circuits of high electric pressure. Next in order the incandescent lamp was developed, and was best adapted to operate at a constant pressure of about 110 volts. The arc lamp seemed best adapted for out-of-door service, the incandescent for indoor use. Two classes of dynamos were developed, one to supply constant current at a high or low electric pressure, according to the number of lamps on its circuit, the other to maintain a constant pressure and deliver a variable current depending on the number of lamps connected. The high pressure of arc circuits made distribution from them economical over long distances, while the constant and moderate pressure of incandescent plants adapted them to supply limited areas. Incandescent lamps were close to the dynamo, arc lamps might be far away.

The electric motor was developed and found best adapted to constant pressure circuits. Not being limited to the then highest practical pressure for incandescent lamps, it was in many cases designed for higher voltages in order to extend the practical area of power distribution. Meantime the demands of incandescent service increased, larger areas were served from a single station, and additional stations of the same kind were built in large cities. Still large districts remained unserved. Inventors had been at work, a new system of distribution was announced with alternating currents. Its particular aim was to reduce the cost of conductors and extend the practical area of incandescent service.

The alternating current transformer was the key to this system. High electric pressures were generated by alternating current dynamos. Currents were distributed over large areas through their small conductors and transformed at the consumers' premises to the voltage required by his lamp. Alternating dynamos being used exclusively with transformers had the features of construction especially suited to that purpose. Rapidly changing values of the exciting current are desirable in transformer operation, since the output, other things being equal, varies with the activity. High frequency or rate of alternation was attained by the necessary design.

One of the notable features in alternating generators was the number of poles. This was large because of the changes of current direction per unit of time; that is, the rate of alternation represents the product of the number of poles by the revolutions per time unit. Sixteen thousand alternations per minute became common practice; with one thousand revolutions this meant sixteen poles. The multiplication of poles beyond a certain point in a dynamo of given speed and capacity, renders the construction more expensive. This point is usually exceeded in alternating generators.

The great difference between direct and alternating dynamos is the commutator. The electric pressures and currents generated in the windings of all dynamos are alternating. The addition of a commutator changes a dynamo from alternating to direct considering the current delivered.

The commutator is an expensive element in dynamo construction. Its omission tended to offset the expense of numerous poles, and the net result was that alternating generators cost about the same as direct. Conditions became quite settled on these lines; for incandescent service at a distance alternating current was always chosen; for supply near at hand, the direct. This was especially true for isolated plants where direct current prevailed to the exclusion of the alternating. For some time direct current motors held the field, alternating motors were impractical, inefficient and costly. Later the alternating motor for two and three-phase circuits has been developed to a point where it compares favorably with the direct.

A lower rate of alternation has been found desirable for motors than has been common for incandescent service. Instead of 16,000 alternations per minute, from 3000 to 5000 have proved more suitable. In place of 16 poles for a dynamo at 1000 revolutions, the number may readily drop to four, for motor work. This decrease in the number of poles cheapens the cost of construction, and an alternating dynamo of these low frequencies can be built to-day at a less cost than one for direct current of the same speed, capacity and efficiency.

Meantime the incandescent lamp has improved, and the practical limit of its operative pressure doubled. This doubled pressure multiplies by four the area of economical service, without the intervention of transformers. As the case now stands, alternating generators of low frequency and without commutators, are cheaper to build, more easily cared for, and have a lower rate of depreciation than direct current machines, while the higher voltage of incandescent lamps makes it practical to distribute motors and lamps from the same mains over considerable areas, direct from dynamo to consumer. The higher voltage of lamps tends to increase the amount of direct service with direct or alternating current machines, while the advantages of the alternating generator give it a preference in some cases over the direct current type.

Many such plants are now operating large factories. A case in point has been lately reported at one of the government yards. In a space some hundreds of feet in each direction a large electric light and power equipment is to be installed, with about 2000-hp generator capacity. Several shops are lighted and a large amount of machinery electrically driven. The dynamos and motors in this plant are of the alternating current type, the pressure is about 220 volts, and no transformers are used. Light and power are produced with current from the same machines. An installation on these lines gains all the advantages incident to alternating dynamos and motors, but escapes the objectionable cost, low all-day efficiency and depreciation losses of transformers. At the same time the electric pressure is high enough to insure a moderate cost for conductors over the distances covered in this case. Plants of this sort are multiplying, not only for isolated or factory work, but as central station. In some cases local conditions or the desire to supplement the generator equipment with a storage battery make direct current machines necessary. In other locations the desirable features of alternating generators, freed from the disadvantages of transformers, will give them a preference for direct service.

Convention of American Electro-Therapeutic Association.

DR. WALTER H. WHITE.

THE ninth annual convention of the American Electro-Therapeutic Association was held in Washington, D. C., Sept. 19, 20 and 21. The programme included the titles of thirty-six papers and the reports of seven standing committees on scientific questions. Dr. D. Percy Hickling, of Washington, as chairman of the local committee on arrangements, was indefatigable in his personal attention to the welfare of the Association and its members, in which he was ably assisted by Dr. Robert Reyburn; otherwise, however, the medical profession of Washington did not take the interest in the proceedings that has usually been manifested at its meetings. It was decided to hold the next meeting in New York City, the successful meeting of 1894 under the management of Dr. Robert Newman, of that city, possibly having had influence on this selection.

Owing to the illness of the president, Dr. Francs B. Bishop, Dr. Walter H. White, of Boston, vice-president, presided over the convention. At the election of officers, Dr. White was named as president for the coming year. The other officers elected were as follows: Dr. D. Percy Hickling, of Washington, first vice-president; Dr. Charles O. Files, Portland, Me., second vice-president; Dr. Richard J. Nunn, of Savannah, Ga., treasurer; Dr. George E. Bill, of Harrisburg, Pa., secretary. Executive Council: Dr. Charles R. Dixon, Toronto, Can., and Dr. F. Schavoir, Stamford, Conn.

The report of the standing committee on "Direct Current Generators and Controllers" referred to the advantages in medical work which the dry cell possesses over the liquid cell, especially for batteries employed in portable work. A series of tests which were begun about a year ago in the electro-therapeutic laboratory of the University of Michigan upon the efficiency of various dry cells for electro-therapeutic work, are still in progress, but the results obtained thus far are stated to justify the hope that the dry cell will in time become a very satisfactory substitute for the fluid cell for both the stationary and portable batteries required by physicians

Secondary batteries are condemned as most troublesome and expensive. While dynamo circuits are a convenient source to those favorably situated, the report states there are such varieties of voltages that the controllers so far designed for one circuit are useless on another of different voltage. An arrangement for the use of direct current for therapeutic purposes was described, for which the advantages were claimed of a wide range of capacity, safety to the patient, ready and convenient means for varying the strength of the current, exact and instantaneous measurement of the e. m. f. and amperage, and means for changing the direction of the current without disturbing the electrodes when they are in position. The resistance of the rheostat included is 10,000 ohms, and the resistance of the patient's circuit, which is in shunt with the main circuit, can be closely regulated, thus enabling the amount of current given to the patient to be varied at will. Lamps employed as resistances can be so connected as to enable a 110-volt, 220-volt or 500-volt circuit to be used. It is stated that this arrangement possesses two notable advantages for controlling direct currents, as follows: The graphite shunt rheostat of very high resistance permits of a very gradual admission of current to the patient's circuit when closed for treatment, and a very gradual withdrawal when the treatment is ended. Also the pole changer in the patient's circuit enables the operator to reverse the current without disturbing the position of electrodes or modifying the arrangement in any other particular, which is especially advantageous in treatment by electrolysis where reversal of polarity is often required. A simultaneous record of the e. m. f. and the current enables the operator to determine at any moment the number of watts being expended in treatment and, with the addition of a record of time, furnishes a means for determining the exact amount of energy which goes to the tissues during each treatment.

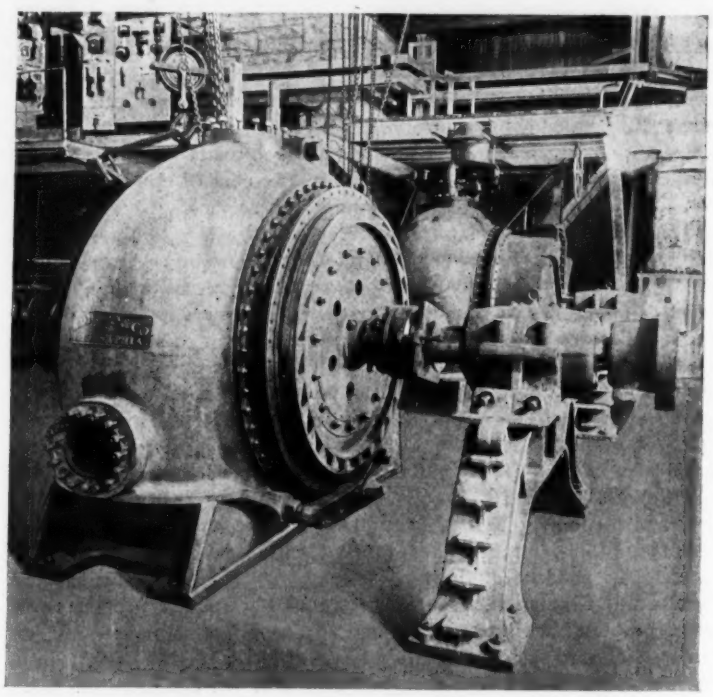
In a supplementary report, Dr. Robert Newman, mentions the introduction on the market of several new electro-therapeutic devices, without, however, giving any decided opinion as to their merit, or any recommendation as to adoption. Dr. E. W. Smith, of Terre Haute, Ind., it was stated, has constructed a new dynamo generator for direct, interrupted and alternating currents.

Dr. Robert Reyburn, in a paper entitled "Power of X-Rays to Penetrate through Metals," gave an account of experiments as to the opacity of metals to Röntgen rays. A Toeppler-Holtz static machine having six 26-inch discs was used in connection with circular condensers. A number of metallic bodies was placed upon suitably wrapped photographic plates and exposed to Röntgen rays for fifteen minutes at a distance of 3½ inches from a Crookes' tube. Among the metallic bodies was an electrotype copy of a coin, and upon developing the photographic plate, it was found that the design of the coin had, as it were, been driven through by the rays and had been impressed upon the paper-covered plates, while the other objects had only been copied in outline. Dr. Reyburn considers that this shows it would be quite possible to copy engraved plates of any kind, medals, medallions, etc., by means of Röntgen rays, and further investigation, he stated, has confirmed this opinion.

Dr. Elmer Gates read a paper entitled "The Distribution of the Electric Current in a Conductive Substance," in which he stated that he was led to the study of this subject by the following experiment. An ordinary photographer's sensitive plate was placed within a completely light-proof and dry envelope paper and then held between the knobs of a static machine, and a single spark allowed to puncture the envelope and strike the plate. The film side of the plate was toward the positive terminal. The static machine was not running at its fullest capacity, so that when the terminals were drawn far apart only a brush discharge was exhibited. The paper was punctured near the centre of the plate and a print from the negative showed that two sparks instead of one were discharged. A broad white streak showed the light effects of the first spark and a narrower white streak showed that part of the current of the second spark jumped over the side of the plate while part of it was conducted through the film, producing a record of its various mutually special, and diverging paths. Dr. Gates stated that he made 150 such "electrographs" and they all present such peculiar branching effects. He, therefore, concludes that when a body is struck by lightning and a print is found upon the skin resembling a tree, it is obviously not due to any photographic effect on the surrounding trees but to the natural way in which the current distributes itself in a conductive substance. He stated that the electrographs made by him conclusively demonstrate that the area of an "electrograph," as he calls the prints, increases with the potential of the current; and that the amount of detail in an "electrograph" at any potential or voltage, bears a close relation to the amount of current. The final conclusion of the paper is that except in an absolutely perfect conductor, the current does not invade all portions of the mass equally; neither does it travel in the dielectric medium, but selects in the conductor a number of special mutually diverging paths. Upon the entrance of a current into the tissues of a conductive substance, the branching effects follow well-marked lines of divergence. When near the periphery of an "electrograph" this current becomes very "numerous" and more devious in its action. The branching of the current increases with the resistance of the conductive substance and diminishes with its conductivity. The area of an "electrograph" increases not only with the potential but also with the conductivity.

More Power from the Niagara Gorge.

Within a few days two additional turbines will be in operation in the power house of the Niagara Falls Hydraulic Power & Manufacturing Company, at the water's edge, in the Niagara gorge. Each of these wheels has a capacity of 2500-hp, and each will be direct connected to two generators. It will be recalled that the wheels in



NIAGARA HYDRAULIC POWER PLANT.

the station of the Niagara Falls Hydraulic Power & Manufacturing Company are operated under a head of over 200 feet. These two new wheels are located on the big penstock last erected, and are fed through 60-inch valves. When these wheels are in operation they will make a total of three supplied from this penstock, and there are valves for two or more wheels. The new turbines are being erected under the supervision of Mr. E. H. Broome.

Sends 80,000 Words an Hour.

A test was made at Budapest of the United Electric Co.'s system of telegraph invented by Pollak and Virag. The test took place in the presence of representatives of several American electrical companies and of the French, Hungarian and German Governments. It was successful. It is asserted that 80,000 words an hour can be sent on one wire by this system, which was recently described in detail in the ELECTRICAL WORLD AND ENGINEER. By the aid of a magnet, a tiny mirror attached to a telephone membrane moves with each making and breaking of the circuit. This mirror reflects a powerful electric light upon an opening in a drum behind which a roll of sensitized photographic paper passes as the light plays. Upon this paper telegraphic signals at the rate of 400,000 per hour can be recorded. This would give 80,000 words an hour, on the average, of complete telegraphic messages. The sensitive paper is developed in a few moments, and this gives the operator the signals from which the telegrams are written out.

Electrical Features of the Dewey Celebrations in New York.

THE arrival of Admiral Dewey on his ship Olympia, from Manila, was the occasion of a great celebration in New York City last week, and the whole of Greater New York was en fête for three days, while hundreds of thousands of visitors from other places came to join in the exercises. On Friday, Sept. 29, there was a grand marine parade by day from the lower bay up the Hudson to Grant's Tomb, when Dewey was escorted by several men-of-war and eight hundred other craft big and little. In the evening there were fireworks and illuminations. On Saturday the Admiral and his captains and the Manila crew of the Olympia were escorted by 30,000 regular and other soldiers, from the fleet at anchor off the Tomb to Madison Square, where a fine triumphal arch and court of honor had been erected in staff. There were illuminations again in the evening.

A few years ago, the electrical effects seen during the Dewey days would have come in for unending praise, but they are now so common and familiar as to be accepted almost without comment, though with generous admiration. Last week New York was full of electric light stars, wreaths of lamps, flags waving operated by commutators, portraits of Dewey set in jewels of lamps, and other effects of that kind. It would be mere waste of space to enumerate them. There were, however, one or two particularly ambitious pieces. Perhaps the most beautiful effect of all was the Dewey Arch itself, on which were focused almost incessantly the beams of searchlights in the vicinity. The white staff glistened with the polish of marble and the view through the arch up and down Fifth Avenue, showing the rows of arc lights along the famous thoroughfare was indeed very fine.

The next thing of magnitude was the electrical sign on the Brooklyn bridge, not a thing of beauty intrinsically, but visible fifteen or twenty miles away, and at the same time exasperatingly difficult to photograph. The sign "Welcome, Dewey," we are informed by Mr. C. C. Martin, chief engineer of the Brooklyn bridge, contained no fewer than 8000 lamps of 16-cp each. The letters were over 30 feet high and the sign occupied a large part of the bridge front facing toward the anchorage of the men-of-war off Staten Island. Current was furnished by the dynamos of the bridge power house, at 500 volts, the lamps being strung 5 in series. The electric cable that supplies power to the middle section of the bridge railroad was tapped near the center and the circuit was carried to the base of the sign. From that point feeders were run to each letter, where a switch was located, so that each letter had an independent supply of current. While the sign was in use, the cars were hauled over the bridge by cable, in order that the current could be thus diverted and be steady. The contractor was Mr. W. H. Boyes, who is certainly entitled to great credit for overcoming the difficulties encountered, chief among which was a whistling gale which broke between three and four thousand lamps, and included in which were strikes by linemen who though they had him in a tight corner. The whole work was well designed and well carried out.

Another striking effect was that on the tall chimneys or "smoke stacks" of the Edison building on Elm and Duane streets. These stacks are popularly known as the "Heavenly Twins." Around each were put three circles of 9 arc lamps, in red, white and blue globes, making 27 on each stack and 54 in all. The effect was very pretty and striking, but we have been obliged to consign to oblivion and obscurity all of the attempts of the photographers to do it justice. It needed an impressionist rather than a camera.

During the illuminations on Friday night, the fleet of war ships and yachts was brilliantly illuminated, and searchlights were flashing in every direction, but the palm must be awarded to Sir Thomas Lipton's steam yacht Erin, on which no fewer than 1500 lamps were employed, ranging from 5 up to 16-cp. Not only were there shown English and American flags with lamps around them, but between the two masts the name "Erin" shone forth in all the glory of 10-foot letters and of 500 lamps. There was also a Dale electrical sign spelling out the name "Shamrock" in letters 14 feet high, and in addition there was a fine searchlight. The work was done by Mr. W. H. Fleming and was decidedly the finest thing of the kind afloat that night, even if some of the battleships did run it pretty hard.

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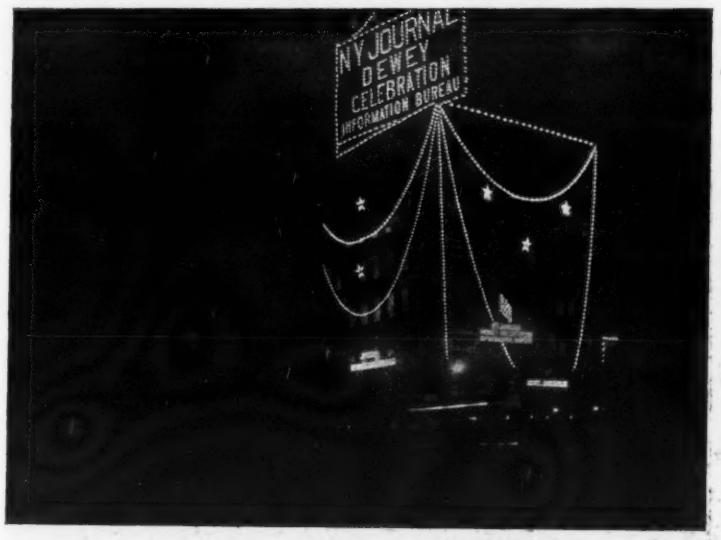
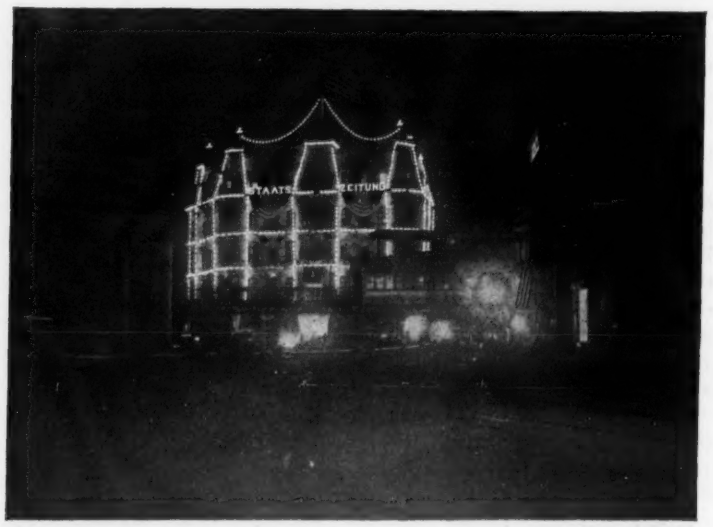
8000-LAMP SIGN ON BROOKLYN BRIDGE.





ELECTRICAL ILLUMINATIONS HOTEL BARTHOLDI AND "STAATS ZEITUNG" NEWSPAPER.

One of the novel features of the decorations along the route of the water parade was a miniature of the Olympia, perched upon the brink of the cliffs at the top of Hudson street, Fort Lee, opposite Grant's Tomb. It was 175 feet long and 47 feet high, covered with electric lights, 4000 in all. It is said that a Dewey sign of similar Brobdignagian proportions was set up at the entrance to the Harbor, but "corroborative details" are lacking. There were

several fine illuminations along the river fronts, especially on the Hudson River. Both the Pennsylvania and the Delaware, Lackawanna & Western Railroads had big "Welcome Dewey" signs built up from hundreds of incandescent lamps, and the dock on the New York shore of the American Line was also very brilliant.

In addition to giving spectacular brilliancy to the Dewey welcome home, electricity had a great deal to do in supplying swift transportation to the crowds. It appears that the Metropolitan Street Railway Company and the Third Avenue Railroad Company together carried during Thursday, Friday and Saturday last 1,203,320 more passengers than on the corresponding three days last year. On the Metropolitan system the average daily receipts amount to $40,000, and the number of passengers every day is about 800,000.

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THE DEWEY ARCH BY SEARCHLIGHT.

Last Thursday week the receipts were $55,950, and on Friday they reached $65,219, an increase of $28,600 over the same date of last year. Saturday's traffic, despite the fact that the lines were cut in two for six hours, netted $50,972, and $35,374 was taken in on Sunday. There was a total increase of passengers to the number of about 1,753,300 during the four days and of about 1,042,820 within the first three days.

The Third Avenue line carried 572,500 people from Thursday morning to Saturday night, which was 160,500 in excess of last year's record for the corresponding days. This shows an average increase of 53,500 passengers for each day, excepting such reductions as should be made on account of transfers.

Special arrangements had to be made by the telegraph companies and the American District Telegraph Company to carry on their business on Saturday, and for twelve hours the delivery system of both companies was entirely rearranged. The presence of such a crowd on the West Side, from Grant's Tomb to Washington Square, doubled the business of the telegraph companies. This was expected, for the experience which the companies have had with parades and celebrations in the past has taught them that there is always a certain proportion of men and women who want to telegraph. A week ahead the Western Union began to increase its force of operators in the Columbus avenue, Amsterdam avenue and Broadway offices. On Saturday twice as many telegraphers were at work on the West Side as under normal conditions. The business was handled without unusual delay and the average person sending a message did not realize that extraordinary measures had been taken to ensure its delivery.

The District Telegraph Company had another problem to face. The parade route cut through and across every delivery district on the West Side. The uniformed messengers of the company are usually permitted to pass police lines without interference, but to cross the line of a parade causes delay, and the boys have not always proved strong enough to resist the temptation to watch the soldiers. On account of this the delivery districts were entirely recast, so that no boy was compelled to cross the parade route to deliver a message. As soon as the parade was over the regular district lines were re-established.

Through the enterprise of the New York & New Jersey Telephone Company represented by Mr. B. E. Loomis, and Mr. Ira W. Henry and H. T. Richards, of the Safety Insulated Wire & Cable Company, Admiral Dewey, on his arrival, was put in speaking distance with all parts of the United States by long-distance telephone connection. As soon as the "Olympia" dropped anchor off Tompkinsville, Mr. Loomis, district telephone manager of Staten Island, was ready with his corps of assistants, and ran a land line from the water's edge to the Staten Island Central Office. Word had been sent to the Safety Company to have ready a reel of their flying submarine cable, manufactured for army and navy use, such as had been successfully used in the campaigns in Cuba and Porto Rico, and is now in operation in the Philippine Islands. This cable is made especially with the idea of lightness and extreme flexibility, and is so constructed as to be impervious to the action of salt water, besides having an extremely high tensile strength in relation to its diameter, which is only ¼ of an inch.

At sundown on Wednesday, after all visitors had been ordered away from the ship, the naphtha launch, "Vesuvius, Jr.," with a reel of cable mounted in her stern, having on board Mr. Loomis, Mr. Richards and Mr. Henry (the designer of the cable) started from the Tompkinsville shore. After they had connected the shore end with the central office, the cable was rapidly played out, and in ten minutes the launch was alongside of the "Olympia." The instruments were quickly passed aboard, and the cable drawn up and lashed at intervals to the anchor chain, thus allowing the ship to swing at her anchor without interfering with the circuit. Inside of half an hour connections had been made, and the long distance line called up in several cities.

Admiral Dewey and his officers were profuse in their congratulations to the above-mentioned gentlemen, who, after spending a pleasant evening on board the flagship returned ashore much pleased with the perfect success of their enterprise. This cable connection was extended as a courtesy to the officers and men of the "Olympia" by the two above-mentioned companies, and free service was rendered for calls to any point in the United States. This is the first time that anything of this kind has been attempted, and its perfect success in connection with the reception of Admiral Dewey will make it of historic importance.

Delivery Wagons for Dry Goods Stores.

Some little while ago we illustrated the delivery wagon built as a type, by the Woods Motor Vehicle Company for the United States

ELECTRICAL DELIVERY WAGON.

Express Company. Herewith is shown another type built by the same concern for one of the large dry goods houses. The load that can be carried by such a vehicle is 1500 pounds. The mileage capacity or radius is 25 miles on one battery charge, and a maximum speed can be made of ten miles an hour. These vehicles will climb with full load a 6 per cent. grade easily. Forty cells of battery are used, and motors are placed on the rear axle.

CURRENT NEWS AND NOTES.

RIGGING THE COTTON MARKET.—The Savannah Cotton Exchange, on Sept. 29, had a violent panic, and then suspended all business, as the result of the receipt of misleading quotations of the Liverpool Exchange. At this writing the affair is still very much of a mystery, but every effort is to be made to clear it up and punish those who were either guilty or were culpably careless.

POLE INSULATORS.—Four patents were granted Sept. 19 to F. H. Withycombe, of Montreal, Canada, on forms of pole insulators so fashioned as to reduce damage if the insulators are made the targets of stones or other missiles. The invention relates to the special construction of the exposed surfaces of the insulators, the smooth outer surface being replaced by protuberances, ridges or depressions, forming an exterior construction which will break down readily with the impact of missiles, thus relieving the main portion or body of the insulator from the full severity of the impact. In two of the forms patented, conical or cylindrical protuberances form the surface of the insulator. In a third form parallel ridges project from the surface, and spiral ridges in the fourth form.

EXAMINATION FOR ELECTRICAL ENGINEER AND DRAFTSMAN.—The United States Civil Service Commission announces that on Oct. 17, 18 and 19, 1899, examination may be taken at any city in the United States where the Commission has a board of examiners for the position of electrical engineer and draftsman. This examination will consist of the subjects mentioned below: Mathematics, theoretical questions in electricity, practical questions in drafting, technical education and experience. From the eligibles resulting from this examination certification will be made to the position of electrical engineer and draftsman in the supervising architect's office, Treasury Department, at a salary of $1400 per annum. This examination is open to all citizens of the United States who comply with the requirements. All such citizens are invited to apply. They will be examined, graded and certified with entire impartiality and wholly without regard to any consideration save their ability as shown by the grade attained by them in the examination. Persons desiring to compete should at once apply to the United States Civil Service Commission, Washington, D. C., for application forms 304 and 375, which should be promptly filed with the Commission.

POLYPHASE WATTMETER.—A patent was granted Sept. 26 to George Hummell, of Munich, Germany, for a three-phase wattmeter on the two-wattmeter principle, but with a phase displacement of but 30 degrees in the shunt coils. Designating the wires of a three-phase circuit by *a*, *b* and *c*, the stator coil of the meter, *A*, is in series with *a*, and the stator coil of meter *B* in series with *b*. The shunt coil of meter *A* is connected between the conductors *b* and *c*, and the shunt coil of meter *B* between the two conductors *a* and *b*. In each of the shunt coils is placed an inductance of such a value as to effect a backward shifting in phase of 30 degrees. It is stated that in meters constructed on the single-phase or Ferraris principle, it is essential that the currents in the shunts bear a 90-degree phase relation with respect to the currents in the series coils, and that such a phase shifting can only be obtained by knack, or, at any rate, a very great inductance is needed and the phase shifting is dependent upon the frequency. If, on the other hand, only a small phase shifting is necessary, as in the present case, the necessary inductances are smaller and the degree of phase shifting obtained is less dependent upon the frequency.

ELECTRIC RAILWAY RAIL BOND.—A patent was issued Sept. 26 to Thomas J. McTighe, of New York, for a flexible electric railway rail bond formed of a single piece of wrought metal and with laterally projecting terminals so shaped as to facilitate their application to the drilled holes in the rail and effect a tight and permanent contact therewith. Such a bond may be made of a single piece of wire rod by upsetting, shaping and flattening, after which the flattened surface is slit by means of dies to make it flexible, the slits, however, not extending to the terminals. The rail bond thus formed is quite flexible, and will yield to lateral and vertical movements of the rails, and will allow for contraction and expansion; but it is proposed to also bend the strap into an S-shaped or other curve. The terminals, which are integral with the strap, are cylindrical, and have countersinks. After the terminal is entered into the hole in the rail a conical pin is pressed home by hydraulic means in the countersink, and the continued application of pressure causes the other side of the hydraulic press used to act upon the under end of the terminal and compel the metal from that side to flow down the conical face of the pin and spread out and completely fill all the irregularities in the holes of the rail.

COMPOSITE WIRE.—A patent was issued Sept. 26 to Orlando M. Thowless, of Newark, N. J., on a composite wire and a process for its manufacture, the principal use of the wire being to act as a substitute for platinum leading-in wires for incandescent lamps. The wire consists of an internal platinum core and an external covering of nickel or nickel alloy. The interior surface of the nickel tube is chemically cleaned by means of a mixture composed of about 20 parts nitric, 10 parts sulphuric and two parts of muriatic acid. After the new surface is produced, in order to insure against oxidation the tube is immediately placed in a concentrated solution of borax and water, where it remains until it receives the platinum cylinder, which latter must also be freed from dirt and grease, so as to be chemically clean. The platinum cylinder having been placed in the nickel tube, the composite cylinder is put into a muffle and subjected to an almost incandescent heat, thereby sweating the two metals together. The composite body may then be drawn to size.

INCANDESCENT LAMP FILAMENT.—A patent was granted September 19 to Orlando M. Thowless for an incandescent lamp filament. An ordinary incandescent lamp filament is fitted with a sheath of non-conducting substance, consisting of carbon and aluminia, carbon and tungsten or other similar metallic compound or oxide. One method of producing this non-conducting covering on the carbon filament is to take, say a cotton braid, soak it in nitrate of aluminia, and apply it to a carbon filament or burner. The burner thus covered is submitted to a high degree of heat, and the result is the destruction of the cotton covering, leaving a filament or burner covered with non-conducting material. On this covering is deposited a layer of conducting material by means of the flashing process, after which the central or basic filament may be removed chemically or by burning it out. In order to prepare the non-conducting base for receiving the deposit in the flashing jar, the filamentary strips are thinly coated with a mixture formed by pouring oil of rosemary on bichloride of platinum in a porcelain dish and kneading it until all parts are well moistened. The filamentary strip is then heated in a muffle or over a Bunsen burner, the result being a covering of platinum on the surface of the filament, which can then be placed in the hydrocarbon flashing jar and carbon deposited thereon to the proper thickness. The object of the invention is stated to be to furnish a burner or filament which, while being cheaply constructed, is very efficient and is more durable than any other with which the inventor is acquainted.

THE CANADIAN NIAGARA POWER COMPANY, which obtained a new franchise from the Ontario government, under which, according to the statement of Mr. Wallace Nesbitt, the company's counsel, it is expected that power will be available for transmission to Toronto, has lost no time in getting to work, and active operations for the construction of a big plant will soon begin. By awarding the contract for boring test holes along the line of the tunnel it contemplates building, the company has commenced the preliminary work in connection with the development of power on the Canadian side of the Niagara. Just what the plans involve, just what amount of power will be raised, cannot now be said, but the Canadian Niagara Company has started a work that would lead outsiders to believe that it is a tremendous one. When the big tunnel on the New York side of the river was built, similar test holes were sunk in order that complete information in regard to the class of rock to be met with in building the tunnel would be known. The test holes will be sunk to 200 feet in depth and 4½ inches in diameter. They will be bored with a diamond drill, in order that a core of the rock may be brought to the surface and saved for inspection by the contractors who desire to bid on the work. After the test holes have been sunk, the sinking of shafts will follow, and when these are at a proper depth the boring of the tunnel will begin. As yet the Canadian Niagara Power Company has not stated the size of the tunnel it intends to build, but enough is known to warrant the statement that its dimensions will be ample for the development of a large amount of power.

FRICTION BRAKE FOR POLYPHASE MOTORS.—In a patent issued Sept. 26 to Egbert M. Tingley an automatic electromagnetic friction brake for polyphase motors is described. On the end of the motor shaft are keyed a number of disks, the peripheries of which run in concentric grooves in a case fixed to the motor frame. When it is wished to brake the motor, an electromagnetic arrangement imparts pressure to these disks and the friction thereby caused with the grooved surface brakes the motor. The electromagnetic arrangement consists of two coils, one of which is supplied with current differing 90 degrees in phase from that of the other. When no current is passing, springs forming part of the brake mechanism set the brake; when current flows through the coils, the mutual attraction of the two magnet armatures acts against the spring, which releases the brake, allowing the brake disks to rotate freely. It will thus be seen that the operation of the motor is not impeded so long as the supply circuits remain closed.

TIME-ELEMENT CIRCUIT BREAKERS.—A patent was granted Sept. 26 to L. B. Stillwell on the use of time-element circuit breakers where there is a main supply circuit and two or more subordinate or distributing circuits. This system, which is employed on the Niagara circuits, obviates the difficulty met with of a total interruption of the service from all substations on a main transmission circuit when a fault occurs on the line supplied from any one substation. Assuming a main circuit supplying two distributing substations, A and B, the circuit breaker on the main circuit would be set to act, say, six seconds after an abnormal current appeared on the line; the circuit breaker at the substation nearest the main station would be set to act at an interval of, say, four seconds, and that of substation B at an interval of two seconds. It will thus be seen that if a short circuit occurs on a line supplied from station B, the circuit breakers at the generating station and at station A cannot be in a position to act until after the circuit breaker at B has acted and cut out the cause of the abnormal current.

LAMME PATENTS.—Three patents were granted Sept. 26 to Mr. B. G. Lamme, and also two joint patents, the other inventors of the latter being Mr. J. P. Mallett and Mr. C. E. Skinner, respectively. One of the Lamme patents has for its object to provide a simple and efficient means for varying the e. m. f. at the secondary terminals of stationary transformers without varying the active length of either of the transformer windings or the normal inductive relation of such windings. This method is a substitution for the one usually employed, consisting in cutting out sections of either the main, primary or secondary, both of which methods are attended with difficulty where the primary voltage or secondary current is large. As described, there is an auxiliary sectional secondary winding so proportioned as to have generated therein a comparatively small current and low e. m. f. such as will not interpose any difficulties when sections of it are switched in or out of circuit. In order that the variation of the e. m. f. of this auxiliary secondary coil may be imparted to the main circuit, there is in series with it one winding of a transformer, the other winding being in series with the main secondary circuit. Any increase in the active length of the auxiliary winding will consequently correspondingly reduce the e. m. f. in the main secondary circuit, and vice versa. Another Lamme patent relates to details of alternating current collector rings, the object of which is to provide a ring which will have sufficient current capacity for any variety of work and at the same time shall be so constructed as to dissipate the heat generated therein and prevent the transfer of such heat to the insulation between adjacent rings and between each ring and the shaft or sleeve upon which it is mounted. The collector consists of two concentric bands or rings separated by conducting and supporting arms, the band of smaller circumference forming a sleeve to secure the ring to the shaft and the outer band being a contact ring for the collector brushes. Another patent is on the details of construction of field magnet cores of polyphase machines, with the object to reduce the cost of construction and so arrange the several parts as to insure proper ventilation of both stationary and rotating members, provide well-balanced and effective magnetic circuits and minimize the amount of copper necessary for a given output of energy. The field magnet core is built up of overlapping plates bolted together so as to constitute a laminated fly-wheel of great strength. The magnetic circuits are confined to the laminated structure, and the construction is such that the fluxes are not obstructed or interfered with by defects or joints in the cast-metal spider. The coils are surrounded on four sides by metal—by the core proper and retaining wedges—so that the heat generated is readily transferred to the surrounding metal by conduction, and there dissipated by reason of ventilating openings or passages. The patent above referred to as issued to Mr. Lamme and Mr. J. P. Mallett, is on a new type of distributed winding primarily intended for polyphase induction motors and generators. It is stated that in constructing polyphase generators and motors prior to the present invention, it has been customary to employ end-connections of one form for the primary member or armature coils of one group, and connectors of a different form for joining the several groups in series. In the system patented, all connectors are the same form in length, which results in minimizing the cost of labor and materials and reduces the stray field of the machine, and, consequently, the self-induction of the conductors, at the same time providing a more perfectly balanced field and thereby reducing the tendency to vibration and possibility of derangement of the connectors. In this system as applied to a bar winding, the bars are of three different lengths; the middle or adjacent to the middle bars for the several phases of each pole are alternately long and short and project symmetrically at the core ends; the remaining bars are of intermediate length and project the same distance as the short bars at one end and the same distance as the long bars at the other end of the core. This arrangement admits of end connectors the same in form and symmetrically placed. The patent granted to Mr. Lamme and Mr. Charles E. Skinner is on the details of the field magnet coil of the Niagara machines, which were fully described in our issue of Jan. 7, 1899.

LETTERS TO THE EDITORS.

An Objection to Autobaine.

To the Editors of Electrical World and Engineer:

Sirs:—In your valued paper of July 22 I find a letter to the editors by Mr. C. E. Woods, suggesting the substitution of the term "autobaine" for automobile. Mr. Woods claims that this term is derived from an old Greek word "baine," meaning wagon.

I regret to say that Mr. Woods is entirely mistaken, as the word does not occur either in Greek or in Latin. The Greek words for wagon are hamaxa, harmamaxa and apene, and I cannot understand from what source Mr. Woods obtained his information.

I agree, nevertheless, that we should have a special term for electric automobile. "Automobile" is a bad mixture of Greek and Latin, meaning "self-movable." This applies to steam locomotives as well as to electric street cars, benzine motor carriages, etc. What we need is a more precise expression with reference to the motive power—in this case electricity. Abroad the word "electromobile" has recently come to be somewhat used. It is not much better than automobile from a linguistic standpoint, but I doubt whether the properly derived terms, "Electrokineton" or "Electrokinet," meaning movable by electricity, would ever become popular, though we have adopted other deriviations from the same work; I refer to kinematograph, kinetoscope, etc. But why should we be so scrupulous with respect to electromobile, when we use the Greek-Latin combinations, electromotor, dynamomotor?

O. C. ROEDDER.

BALTIMORE, MD.

Central Station vs. Consumers' Ownership of Arc Lamps

To the Editors of Electrical World and Engineer:

Sirs:—I noticed in your issue of Sept. 23 an editorial comment on the growing tendency among electric lighting companies to give up the supply of arc lamps to their customers, and in this connection I would refer you to an article which appeared in your issue of May 6. A paragraph in this article on the "Arc Lamp Department Station Business" touches upon the subject, "Should central stations purchase lamps, and furnish them free, to merchants?" I think you will find this offers a convincing argument in the affirmative. Since the article appeared I can see even a greater tendency toward the central station controlling this business by making investment for the lamps and selling to the customer current only. It appears to me to be a good business proposition, and results in the avoidance of many troubles and annoyances both to the customer and the central

station. As to the latter, every 100 lamps placed upon the lighting circuits brings in an income of several thousand dollars to the station. The opportunity for pushing business is great when the station furnishes the lamps. The solicitor who is after the business finds it much easier to secure customers, and feels that he is well supported in this particular by the station. On the other hand, where the policy is that the merchant shall furnish lamps, it is most difficult to increase the business or carry on an energetic campaign. I think the statistics will show there are very few stations in the country which have not adopted the policy of furnishing lamps free to merchants, and making a minimum monthly charge for current.

Schenectady, N. Y. H. W. Hillman.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

Dynamos, Motors and Transformers.

Battery Boosters.—Girault.—The conclusion of his article, the first part of which was abstracted in the Digest, July 1, discussing analytically the quantitative relations when a dynamo is placed in series with a battery, both together being in parallel with the main generators, the battery being used for keeping the load on the main generators constant, a method frequently used in railway power plants. He continues the discussion of what he calls a perfect booster, with a double field winding, one constant and the other connected to the terminals of the battery, the latter being the one by which the variation of the voltage is produced to compensate for the variations of the voltage of the battery. He discusses the case in which the constant excitation is produced by a shunt coil connected to the bus bars, and shows that this arrangement is not satisfactory, while the other one described in the previous article, in which the constant excitation is produced by the constant current from the main dynamos passing through a series winding, was perfect. He then discusses the case of over-compounded dynamos. In order to prevent an inversion of the current in the series coil of the main dynamo, it is necessary to connect the cable coming from the booster, with the point of junction of the series coil and the armature of the main dynamos. In order to make the over-compounding of battery and booster equal to that of the main dynamo, it is necessary that the booster also has a special compound winding, and that the line current goes through its series coil as well as through the series coil of the main dynamo. He then discusses briefly the faults of over-compound dynamos, and sums up the results of his investigation as follows: Every continuous current central station should use a storage battery with booster. Series wound boosters operated with constant speed and connected with the different feeders, enable a constant voltage to be obtained at the terminals of the distribution. The main dynamos working with constant power must be simple shunt wound. Even the smallest central station should try such a system.—*L'Ind. Elec.,* Aug. 25.

Over-Compounding Dynamos.—Scott.—A short illustrated article. In over-compounding wound dynamos it is necessary to increase the magnetization at a rate roughly proportional to the load requiring the over-compounding; it is, therefore, important to work between such points on the magnetization curve that the useful lines of force are approximately proportional to the magnetizing force, i. e., on the part of the curve immediately below the bend. An automatic method to enable the machine to work at a higher induction density and still give the same over-compounding, is to put an iron wire resistance in shunt with the compounding coils, its section being so proportioned that an increase of load, combined with the high temperature coefficient of the iron, shunts more and more current through the series coils, thus compensating for the diminishing permeability of the magnetic circuit. A similar arrangement, in which the regulation is by hand, is also illustrated. From the fact that over-compounding tends of itself towards sparkless commutation, he concludes that it is a gain to over-compound a machine, even if that is not necessary from the point of view of getting a steady voltage at some distant point, and he therefore proposes to use over-compound dynamos in ordinary lighting central stations. If shunt wound dynamos at 460 volts used for lighting are afterwards to be used for traction also, the dynamos should be able to give the 560 volts required for traction, simply by the addition of series turns on the field coils; but he shows that this, although possible, is not to be recommended.—Lond. *Elec. Rev.,* Sept. 15.

REFERENCES.

The Short Circuit Curve of Alternating Current Generators.—Rothert.—The conclusion of his long article (Digest, Sept. 30), giving the results of tests made with three other alternators, in the form of diagrams and tables. He claims that these tests prove the usefulness of his method—*Elek. Zeit.,* Sept. 14.

Goldschmidt.—A communication claiming that two of the statements in Rothert's first article are incorrect.—*Elek. Zeit.,* Sept. 14.

Synchronizing Alternators.—Gardner and Howgrave-Graham.—The conclusion of the illustrated paper mentioned in the Digest, Sept. 30, describing some further synchronizing methods with lamps or telephones, Ayrton's electrostatic synchronizer, and the optical synchronizing method in which as many spots are painted on the revolving part of the machines as there are alternations per revolution and they are lighted from an arc supplied with the armature current. —Lond. *Elec. Rev.,* Sept. 15.

Regulation of Alternating Current Generator.—Cory.—A reprint of a paper with many curves, read before the Pacific Coast Electric Transmission Association, discussing mainly the drop of pressure through the armature and the change in the strength of the magnetic field due to the demagnetizing action of the armature current. It is an interesting description without giving anything new.—*Jour. of El'ty,* August.

Sparking of Continuous Current Machines.—Fischer-Hinnen.—An illustrated French translation of page 196 to 228 of the recently issued fourth German edition of his treatise on continuous current dynamos. The matter is nearly identical with that in his long article, abstracted in the Digest, Jan. 14 and 28.—*L'Eclairage Elec.,* July 15, 22.

Power.

Electrical Engineering in Switzerland.—The conclusion of this long serial contains a description of the Kanderwerk, a power plant six miles from the Thun terminus of the Burgdorf-Thun Railway, supplying power to this railway, to Berne, 25 miles distant, and to some of the intermediate towns. Water power is used to drive six turbines coupled directly to 300-hp three-phase alternators, with internal field magnets, and having on the same shaft four-pole exciters, generating 270 amperes at 55 volts, which are themselves excited by two independent turbine-driven, 120-volt, 170-ampere machines in parallel, which also serve as a stand-by for lighting the station. This arrangement ensures a better regulation in a turbine-driven plant than shunt-wound exciters. The generator pressure is 4000 volts and there is a 4000-volt network for lighting and power distribution for comparatively short distances from the plant. For transmission to the more distant points, eight transformers, each of 300-kw, raise the average to 16,000. Three are connected in delta for the Burgdorf-Thun railway circuit, which has an independent 16,000-volt feeder. Three others are connected in delta for the 16,000-volt transmission to Berne, but in this case a fourth transformer is in parallel to the phase from which the lighting circuits are taken at the intermediate towns. The eighth transformer is for reserve. At Berne there are transformers stepping down to 3000 volts outside the town, and in the town there is a further transformation to 250 volts on each phase, the motors being connected on the three-phase and the lighting on a 2 by 125-volt three-wire network on each phase. Some of these installations are not yet completed. The small municipal station, supplying three-phase current both for lamps and motors in Thun, is also described; also the Thun Industrial Exposition and the Interlaken Central Station. In conclusion, some notes on the present state of the Jungfrau Railway plant are given.—Lond. *Elec.,* Sept. 15.

Three-Phase Current Transmission in Nova Scotia.—A short illustrated article describing the three-phase long-distance transmission plant, which replaces the former direct-current steam plant of the Lunenburg Company. Water power of the Mush-Mush River

is used, one mile from Mahone and eight from Lunenburg. A 100-kw, three-phase alternator generates current at 3200 volts, which is transmitted over a three-wire pole line running to Mahone, where one large transformer reduces the current to 104 volts. From there it runs to Lunenburg, where the old three-wire direct current distribution has been divided into three sections, two having each two transformers, the third only one, the transformer at Mahone "making the balance on that phase." The distribution is said to be much better than with the previous system.—*Can. Elec. News,* Sept.

Electric Power in Engineering Works.—BELL.—A very well illustrated article showing by numerous examples, that by distributing power electrically and doing away as far as practicable with idle-running and under-loaded shafting, the gross amount of power needed for a given output is considerably reduced; that by centralizing the power plant and distributing electrically, the net cost of the power for the given output is greatly decreased; that by electric driving applied to special and portable tools and to means of transportation, the labor item in the cost of manufacture falls off to a notable degree; and finally that special electric processes and electric lighting greatly facilitates the manufacturing operations, and not only improve the output, but betters the general "morale" of the shop on which depends the ultimate economy of manufacture.—*Eng. Mag.,* Oct.

American Engines for the Glasgow Electric Tramways.—The discussions which have been taking place in the Glasgow City Council, in connection with the contract for engines for the Glasgow municipal tramway station, have excited very great interest in England and have brought out a large number of articles, communications and editorials in the English electrical papers. Upon a request by the Tramway Committee, Mr. Parshall (an American), as consulting engineer, had drawn up a specification which should enable all experienced manufacturers to tender to their own standards. He had given, however, two sets of dimensions merely as suggestions, which were taken from actual working machines of American manufacture. Of four tenders received one was from an American firm, one from a Glasgow firm, and two from Bolton firms. Mr. Parshall recommended the American tender on account of the quality and quick delivery, although its price was the highest; the Council did not accept this, but wished him to draw up a new specification. The Tramway Committee, however, did not consider this to be proper, and had interviews with representatives of the tenderers, which resulted in recommending the division of the contract between the American Company and one of the English; the Council finally agreed to this arrangement.—Lond. *Elec., Elec. Rev., Elec. Eng.,* Aug. 25, Sept. 1, 8; *Lightning,* Sept. 7, 14; *West. Elec.,* Sept. 16.

REFERENCES.

Water Power Plants in the United States.—WASHINGTON.—A long abstract of the paper noticed in the Digest, Sept. 23.—*West. Elec.,* Sept. 23.

TRACTION.

Influence of Temperature on the Strain in the Trolley Wire.—EISIG.—In the first part of this article he discusses this influence analytically. If hard copper wire is used, it is practically sufficient to base the calculation on the assumption that the tension for the lowest temperature is 14,200 pounds per square inch, that is, 1100 pounds for a wire of 0.0773 square inch (between No. 0 and 1 B. & S.); this includes a factor of safety of 4, which has been found sufficient in practice and better than 6, as there is then less sag in warm weather; —4° F. is assumed as the lowest temperature. The results of the calculation are given in a diagram, the abscissas representing the temperatures, the ordinates the tensions. For different spans different curves are obtained, all starting from the tension 1100 lbs. for —4° F. If the spans are 33, 66, 98, 131 feet, the tensions are 660, 680, 710, 740 lbs. respectively for 32° F.; 275, 360, 430, 495 lbs. for 68° F. Suppose the wire be strung at the temperature of —4° F. so that it has the same tension in all its parts for this temperature, then if the temperature rises, the tension will be different in different spans; the longer the span, the greater the tension. These differences of tension, however, will be somewhat compensated for by the yielding of the cross wire on which the trolley wire is suspended. As in practice the wire will in general be strung at a temperature higher than —4° F., the real conditions differ from those obtained by this calculation and are somewhat complicated. For making a rough approximate calculation, it is sufficient to assume that all spans are equal to 130 feet and that the decrease of tension per degree F. is about 11 lbs. from —4° F. to + 14°, 10 lbs. from 14° to 32°, 9 lbs. from 32° to 46°, 7 lbs. from 46° to 54°, 6 lbs. from 54° to 68°, 5 lbs. from 68° to 79°, 4 lbs. from 79° to 86°.—*Elek. Zeit.,* Sept. 14.

Consumption of Power in Electric Traction.—BRICARD.—A theoretical discussion of the question of the best acceleration and regulation of speed of electric cars and automobiles until the brakes are applied, in order to obtain the most economical results; no experimental tests are referred to. He concludes that when the efficiency of the machines is not to be considered, it is best to use the maximum traction effort up to the maximum speed, then drifting, and then applying the brakes; that is, to use constant acceleration. But when the efficiencies of all of the apparatus is to be taken into account, it is best to use to a large degree, the second part of the starting curve which is not a straight line; that is, the part for which the acceleration is not constant and which represents the case when the resistances are all cut out, and the current depends only on the counter e. m. f. of the motors and is therefore decreasing.—*L'Eclairage Elec.,* July 8.

Cost of Traction.—An article giving comparative data for the cost of traction with animals and by electricity, based upon information given by certain manufacturers in the United States, in whose works horse traction was replaced by electric traction. In a factory at Lonsdale 11,660 fr. was the cost of the old system of traction per year with animals, and 8250 fr. for electric traction. The respective data for a plant in Whitinsville are 66,425 fr. and 25,030 fr. These numbers are said to be exact and not only approximate; the separate items are stated. The article emanates from the French Thomson-Houston Co.—*L'Elec.,* Aug. 26.

Tramways in Reichenberg.—SCHOOP.—A long, well illustrated description including a number of load curves, of the tramways in Reichenberg, where great topographical difficulties were surmounted, the city being very hilly. The current of 184 amp. at 600 volts is produced by one of two shunt dynamos, connected in parallel with a storage battery, consisting of 290 cells and having a capacity of 264 amp. hours, if discharged in one hour; for short intervals, however, the current may be increased up to 530 amp. and the battery can be charged with a maximum current of 164 amp. The battery is used to assure a constant voltage as long as it is in parallel with the dynamo; during the eight hours of light load the battery alone furnishes the whole current. Some general remarks as to the use of storage batteries are added.—*Zeit. fuer Elek.,* Sept. 10.

Electric Traction in Germany.—An illustrated article on the recent development of electric traction in Germany. There is a tendency to use electricity for freight traffic, especially in the city of Hanover, where 76 freight cars and 10 trucks are in operation. A brief illustrated description is given of the automobile of Siemens & Halske which can run also on the rails of electric tramways, when it takes current from the trolley wire both for running and charging the batteries, and which can run with its own power when not on the rails (Digest, Aug. 5). Also some illustrated notes on electric canal boat towing, referred to in the Digest July 22 and Sept. 2.—*Elek. Anz.,* Sept. 10.

Electric Traction in Paris.—An article on the new traction installations in Paris referred to in the Digest Sept. 16. It is further stated that a line to Versailles, 9 miles long, will be operated with electric locomotives. In the plant Des Moulineaux, alternators of 800-kw generate three-phase currents at 5000 volts, which are transmitted by underground cables to three substations where they are transformed by transformers and synchronous converters into continuous current at 550 volts.—*L'Eclairage Elec.,* July 1.

Isle of Man Tramways.—A short illustrated article describing the extension of the tramways of Douglas on the Isle of Man, about 14 miles from Douglas to Ramsey. It is double tracked throughout and the overhead trolley is used. Two large accumulator stations equalize the load and assist the cars over the steep grades. The power is supplied from five stations. One of them, which is illustrated, contains two 150-kw generators. The engines were made in Canada.—*Can. Elec. News,* Sept.

Proposed Electric Parcel Despatch in London.—An article stating that thirty-seven years ago a 4-foot high and 4 feet 6 inches wide cast iron tunnel was built for a distance of 2¾ miles in London for the pneumatic despatching of parcels, but that difficulties were experienced in using pneumatic pressure on such a large scale, for which reason the scheme was abandoned. Now a scheme is on foot for utilizing this tunnel with the help of electric traction.—*Lond. Elec. Rev.,* Sept. 15; more briefly in *Lond. Elec.,* Sept. 15.

REFERENCES.

Traction Formulas.—PETOT.—An analytical calculation of the maximum effort obtainable at the drawbar of a locomotive or motor car, showing that the formula usually given is not quite correct. (See also the article of Blondel, noticed in the Digest July 22.)—*Comptes Rendus,* May 23, abstracted at length in *L'Eclairage Elec.,* July 8.

Another article by Petot replying to the one by Blondel, is published in *L'Eclairage Elec.,* July 22.

Electric Automobile.—An account of the evolution of the modern electric automobile.—*Elec. Tech.,* Aug. 15.

Automobiles.—BAINVILLE.—A short article on the electric automobiles at the exposition of the automobile club of France, which was referred to in the Digest Sept. 2.—*L'Elec.,* Aug. 26.

Automobile Exposition in Paris.—LAVERGNE.—An article on the second automobile exhibition in Paris, which was held in June and July. (See also Digest Sept. 2.)—*Rev. Gen. des Sc.,* Aug. 30.

Automobile Exposition in Berlin.—A short description of this exposition. The electric automobiles were in the majority. No technical information is given.—*Elek. Zeit.,* Sept. 14.

LIGHTS AND LIGHTING.

Train Lighting.—AUBERT.—A long illustrated article in which, after giving brief descriptions of the different systems which have been introduced, such as the Stone and the Dick, and that used on the Pullman cars in the United States, he describes at considerable length the system used on the Paris-Lyon Railroad, of which he is chief engineer. In all these systems a dynamo is coupled to the axle of the car, from which it is driven, and there is a relatively small storage battery which is merely used as a small reservoir. In each system there is a characteristic method of keeping the voltages of the feeders constant while the speed of the train, and therefore the dynamo varies. In the present system the dynamo has a constant excitation, its speed is exactly proportionate to that of the axle of the car and the voltage at the terminals is practically proportional to the speed; when the voltage is too low, the lighting current is furnished by the battery and when too high, due to an increase of the speed of the train, the dynamo furnishes current for lighting, for its own excitation, and for charging the batteries, and in that case there is a special regulating apparatus which cuts down the voltage; this (which seems to be the chief difference between this and the other systems) consists of a small series motor through which the dynamo current passes, and which has a pulley on which there is a brake to which pressure is applied; when the current becomes too great, the motor begins to revolve against the action of the brake, and this keeps the current constant whatever be the increase of the speed of the train. As in the other systems the switching in and out of the dynamo is done by an automatic switch; there is also an automatic current reverser which reverses the connections when the speed of the train is reversed.—*L'Elec.,* Sept. 2.

A Standard Lamp Specification.—A suggestion for a model specification for the bulbs, ratings, tips, bases, filaments, vacuum, etc. As a standard of light the amyl-acetate lamp is proposed; the mean horizontal candles in a normal 16-cp lamp should not be less than 15 nor more than 17. The initial total watts consumed should not be less than 96 per cent., nor more than 104 per cent. of the rated watts of the lamp; the average initial watts of lamps of any shipment shall be between 97 and 103 per cent. Readings on life tests shall be made at 10, 20, 30, 40, 50 hours; any lamp increasing more than 5 per cent. or dropping and increasing 5 per cent. or dropping more than 8 per cent. of the initial candle-power uring the first 50 hours, shall be disqualified; further readings shall be made at 100 hours and every 100 hours later. The candle power hour area shall be determined upon the basis of exactly constant voltage, maintained at the lamp terminals. Upon this basis 16-cp, 3.1 watts per candle lamps shall have a mean candle power area of 7000; for 16-cp 3.5-watt lamps, it shall be 13,000; for 8-cp lamps, it shall be at least 35 per cent. of the 16-cp lamp area; for 10-cp lamps, it shall be at least 47 per cent. of the 16-cp lamp; for 12½-cp lamps, it shall be at least 65 per cent. of the 16-cp lamp area; lamps of a candle power higher than 16 shall have a pro rata mean area in candle-power hours. A set of rules is given governing life tests.—*Imper. Lamp Gazette,* Aug., Sept. (This journal is published in the interests of a lamp manufacturer.)

Stage Lighting.—A description of the new electric light installation in the Covent Garden Theatre in London. For lighting the stage there are seven battens, each carrying 80 white, 40 amber, 50 red and 50 blue lamps, each of 16-cp, 28 regulators with liquid resistance being used. There are five rows of wing lights on each side of the stage, in each of which there are 75 lights of 16-cp, of which 30 are white, 15 amber, 15 blue, 15 red. The proscenium lights contain each 50 white lights, 30 blue, 30 red, 25 amber.—*Sc. Amer.,* Sept. 30.

REFERENCES.

Incandescent Lamps.—An illustrated article giving some hints on handling incandescent lamps.—*Imper. Lamp. Gazette,* Aug., Sept.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Combined Light and Traction Plant.—An illustrated description of the interesting combined light and traction plant in Coblenz, Germany, installed by the Union Electric Co. (affiliated with the General Electric Co. of this country). For traction, continuous current at 500 volts is used, furnished by two 150-kw continuous current generators which are connected in parallel with a storage battery of 275 cells having a capacity of 296 to 412 amp. hours, if discharged in 1 to 3 hours. For lighting and for power purposes, the monocyclic alternating current system, devised by Steinmetz, is used. The current is furnished by two-pole monocyclic dynamos which give 180-kw for a non-inductive load at a speed of 150 revolutions per minute at 2080 to 2300 volts, the frequency being 50. During the day hours a 50-kw synchronous converter, supplied with continuous current from the traction network, furnishes monocyclic currents to the alternating current network. As the railway stations use light during the whole night, the alternators are run all night. The high voltage alternating current network is underground; separate transformers are used for the lamps and the motors.—*Elek. Zeit.,* Sept. 7.

King's Lynn.—A long, well illustrated description of this English municipal plant, generating its own producer gas which is used to drive gas engines belted to five continuous current dynamos of 40-kw supplying, with the aid of a regulating battery of accumulators and a "balancing transformer," current at 2 × 200 volts to a three-wire distributing network. The battery consists of 225 chloride cells, the capacity being 400 amp. hours for a 10-hour discharge down to an e. m. f. of 1.85-volt per cell. Two "balancing transformers" are placed in a substation in the centre of the district, each being capable of generating a balancing current of 50 amp. in either armature.—Lond. *Elec., Elec. Rev.* and *Elec. Eng.,* Sept. 15.

Electric Lighting in Russia.—A short note on the development of electric light in Moscow and St. Petersburg. In Moscow the consumption was 2200-kw last year and is now 3700-kw, which includes 400-kw for traction. In St. Petersburg the output was 1540-kw in March, '98, and 2340-kw in March, '99. Both installations are to be extended.—*L'Elec.,* Aug. 26.

REFERENCES.

Apartment House.—An illustrated description of the lighting, heating and refrigerating plant of the Lessing apartment building in Chicago, which is said to be the most complete one in America. All the comforts of life that could be desired in such a structure are provided.—*West. Elec.,* Sept. 23.

Voltage Regulator.—EISLER.—An illustrated description of the Chapman regulator, which is in use in the United States, and is about to be introduced into Austria.—*Elek. Neuigk. Anz.,* Sept. 1.

WIRES, WIRING AND CONDUITS

A 40-Mile Aluminium Wire Transmission Line.—PERRINE.—A short illustrated paper read before the Pacific Coast Electric Transmission Assn., on tests and calculations of the 40-mile aluminium wire two-phase transmission line of the Standard Electric Co., of California, from the Blue Lakes power house to the Stockton substation. The line was designed to deliver 1000-kw at 8.8 per cent. loss. The wire is 294 mills in diameter, weighs 419.4 lbs. per mile, and the ultimate tensile strength is 1539 lbs., or 22,700 lbs. per square inch; the stress at 1 per cent. elongation is 800 lbs.; the conductivity by dimensions is 59.9 per cent. of Matthiesen's standard for soft copper. No elastic limit is given, as it is not well defined in aluminium. The wire was strung in warm weather and had been subjected to extremely cold weather, but the measurement of the whole resistance of the line showed that it had not stretched. The resistance was found to be 92 ohms, which corresponds to 42.8 miles. Tests were made of the insulation and the condition of the wire during extremely bad weather. The insulation of one wire against the ground was found to vary from 160,000 ohms on a rainy day to 44 megohms on a clear day. On one day, during a shower, the line varied in a couple of hours from five or six megohms down to a quarter-megohm, but under no conditions falling below 160,000 ohms. An

interesting effect of the self-induction and capacity was observed, namely, that it overcompounds the step-up transformers. The step-up ratio is 2300 to 25,000 and the step-down ratio 23,000 to 2200 with a possible range of 200 volts in the regulator, but when current was put on the line without any load, the voltage rose completely beyond the range of the regulator, which seemed impossible with 25,000 volts initial; the voltage at the step-down station showed 27,000 on the line. There is a rise of potential at the end of the line due to the capacity, but it is only 200 volts, and a rise of over 2000 was observed, which was entirely due to the transformers. A calculation from the constants of the transformers accounts for all but 200 volts of the rise, and an error in calculating the angle of lead in the transformer may account for this. This effect is explained by simple diagrams.—In the discussion which followed, Lee gave some further information as to aluminium and described a very simple joint. It is merely a flattened aluminium tube, the two wires being laid side by side and twisted up in the same way as in the McIntire joint. Cory gave the results of some mechanical tests made in the laboratories of the University of California. Joints were tested which had been made by the linemen on the Stockton line. It was found in every case that the line itself gave way before the joint, showing that at least with joints made recently, the strength is greater than that of the wire. This wire had not been strung, so that it had not been subjected to any mechanical strain or continued vibration.—*Jour. of Elec.*, August.

Twin and Concentric Cables.—A short communication on why a twin cable is sometimes recommended for arc lighting in series in preference to concentric. There are said to be only two possible reasons, that the joining is easier and that the insulation is less likely to break down on twin cables.—Lond. *Elec. Eng.*, Sept. 15.

REFERENCES.

Aluminium for Electric Conductors.—An article on the use of aluminium for electric conductors as a substitute for copper and brass. The information given is based principally upon experiments of the Pittsburg Refining Co. The McIntire Co., in Newark, and the American Electric Fuse Co., in Chicago, are said to have patents for aluminium joints which have proved very satisfactory.—*Elektrochem. Zeit.*, July.

Joints for Aluminium Wires.—A short illustrated description of some sleeves for joints of aluminium wires.—*Elek. Anz.*, Sept. 10.

High Voltage Plug Fuses.—An illustrated description of the new fuses for 250 and 550-volt circuits, referred to in the Digest Aug. 5 and Sept. 2.—*Zeit. f. Beleucht.*, Aug. 30.

Rules and Regulations in Switzerland.—A reprint of the official rules and regulations concerning installations in Switzerland.—*L'Ind. Elec.*, Aug. 25.

ELECTRO-PHYSICS AND MAGNETISM.

Ohm's Law and Vacuum Tube Discharges.—RIGHI.—A description of a curious phenomenon observed in a circuit containing a battery of accumulators, a vacuum tube with dissimilar electrodes, such as a point and a disc, a sensitive galvanometer and a high resistance, usually of distilled water. The tube lights up apparently continuously and the galvanometer indicates a small continuous current. But under these conditions, it is only necessary to change the place at which the resistance is inserted in order to bring about a change, not only in the luminosity of the tube, but also in the intensity of the current. If the tube contains nitrogen at 0.3-mm pressure, and 282 accumulators are in circuit, and the water resistance is 30 million ohms, the current is 5.48 micro-amp. when the resistance is inserted between the tube and the positive pole of the battery, and 0.4 micro-amp. when between the tube and the negative pole. This is apparently contrary to Ohm's law, and is said to indicate that if Ohm's law applies to gases, the discharge is not continuous.—In an editorial note in the Lond. *Elec.* it is pointed out that the assumption of a discontinuity of the discharge hardly explains the phenomenon, unless it is attributable to the different potentials with regard to the earth, of the various elements of the circuit, and a consequent capacity effect. If the battery and galvanometer were not sufficiently well insulated, the mystery would be explained.—*Nuovo Cimento*, August; abstracted in Lond. *Elec.*, Sept. 15.

Electric Discharges Through a Magnetic Field.—MASTRICCHI.—An account of an experimental investigation of the influence of the pressure on electric discharges through a magnetic field, the direction of the discharge being perpendicular to that of the magnetic lines of force. The magnetic influence upon the discharges through a tube containing rarefied gas, decreases with decreasing pressure; it tends to vanish when the pressure approaches to that of the atmosphere.—*Nuovo Cimento*, VII., p. 277; abstracted in *L'Eclairage Elec.*, July 1.

Effect of Compression Upon Resistance.—LUSSANA.—An account of an experimental investigation showing that in all the metals examined, comprising iron, silver, nickel, lead, copper, platinum and certain alloys, the electrical resistance diminishes as the pressure increases, but that such diminution becomes less and less marked as the pressures are higher. A distinction should be made between the temporary change of resistance, probably connected with differences of temperature, and the permanent change attained when equilibrium has been established. The effect of pressure, like that of tension and temperature, is much more strongly marked in pure metals than in alloys.—*Nuovo Cimento*, August; abstracted in *Lond. Elec.*, Sept. 15.

Thermal Properties of Ionized Air.—PETTINELLI.—An account of experiments showing that a hot body cools more quickly in air ionized by a few electric sparks, than in ordinary air. Since such ionized air also produces the persistent nebulosity observed in the case of Röntgen rays, it is very probable that ionization is at the root of all related phenomena.—*Nuovo Cimento*, August; abstracted in Lond. *Elec.*, Sept. 15.

Magnetic Field Due to Polarized Light.—RIGHI.—A continuation of his researches (Digest, Sept. 30) made to reverse the Zeeman phenomenon, in the sense of producing a magnetic field by the action of circularly polarized light upon a strongly absorbing gas. He failed to produce the effect sought, but found an upper limit above which the effect, when discovered, need not to be expected. In his experiment any magnetization of the gas of an intensity above 10 to the minus sixth power absolute units, would have been observed; but no effect was obtained.—*Nuovo Cimento*, August; abstracted in Lond. *Elec.*, Sept. 15.

Magnetic Properties of Iron at Low Temperatures.—CLAUDE.—An account of ballistic measurements indicating that, contrary to what is usually supposed, the permeability and the hysteresis of iron do not increase as the temperature diminishes, but remain constant to within about 2½ per cent. between 25° and —185°, when the maximum induction is about 15,000 units. With lower inductions, there is a decided falling off in the permeability and the hysteresis at lower temperatures.—*Comptes Rendus*, Aug. 21; abstracted in Lond. *Elec.*, Sept. 15.

REFERENCES.

Electric Deformation of Dielectric.—SACERDOTE.—In a French Academy note he gives a preliminary account of a mathematical theory of the deformation of a solid isotropic dielectric, when it becomes the seat of an electric field. He claims that all discrepancies which apparently occurred in former experimental researches of other investigators, are due to mistakes and that his theory is in agreement with all former measurements.—*L'Ind. Elec.*, Aug. 25.

Dependency of the Capacity of a Condenser on the Frequency of the Alternating Current.—HANAUER.—An illustrated French translation in abstract of the article noticed in the Digest, Dec. 10, '98, and March 18, '99.—*L'Eclairage Elec.*, July 8.

Electric Discharges in Rarefied Air.—EBERT.—Long, illustrated abstracts of two papers, one on electric discharges in rarefied gases, alternating currents of a high frequency being used with the aid of specially devised apparatus; the other on the energy dissipated by such currents in vacuum tubes. These papers were abstracted in the Digest, Dec. 10, '98, and May 6, '99.—*L'Eclairage Elec.*, Aug. 5.

Spectra of Oscillating Discharges.—HEMSALECH.—A reprint of the French Academy paper noticed in the Digest Sept. 16.—*L'Ind. Elec.*, Aug. 24.

Globular Discharge.—A description of the experiments of Leduc, referred to in the Digest, Sept. 2. The latter journal also contains accounts of similar experiments made by Planté in 1878.—*L'Eclairage Elec.*, July 15; *Cosmos*, July 29; *West. Elec.*, Sept. 9.

Electrolysis Induced by Röntgen Tubes.—BORDIER and SALVADOR.—A reprint of the French Academy paper, abstracted in the Digest July 29.—*L'Eclairage Elec.*, July 8.

Cathode and Röntgen Rays.—SANDRUCCI.—A paper discussing the influence of magnetism upon the direction of cathode rays and upon the production of cathode and Röntgen rays.—*Nuovo Cimento*, VII., p. 112; abstracted in *L'Eclairage Elec.*, July 1.

Magnetic Deflection of Cathode Rays.—SCHUSTER.—A criticism of Kaufmann's article mentioned in the Digest Aug. 6, 1898.—*Wied. Ann.*, July, '98; abstracted in *L'Eclairage Elec.*, July 1.

Radiography.—NIEWENGLOWSKI.—An illustrated account of some recent improvements in radiography.—*Cosmos,* Aug. 5.

Nature of Gaseous Conduction.—BOUTY.—Reprints of the two French Academy papers abstracted in the Digest, Sept. 9.—*L'Eclairage Elec.,* Aug. 5.

The second one is reprinted in *L'Ind. Elec.,* Aug. 25.

Chemical Composition and Electrical Properties of Glass.—GRAY and DOBBIE.—An abstract of a Royal Society paper, giving the results of measurements of the specific resistance and specific inductive capacity of several varieties of glass.—Lond. *Elec. Eng.,* Sept. 15.

Physics.—POYNTING.—A very interesting address of a general nature, presented to the Mathematical and Physical Section of the British Assn. The laws of nature are said to be nothing but "brief descriptions of observed similarities." He discusses the atomic and molecular hypothesis of matter, the forms in which it has been expressed, the possibility to find other types of expressions, and the limits.—*Science,* Sept. 22; Lond. *Elec.,* Sept. 15.

Development of Science in This Century.—FOSTER.—The first part of a very long abstract of his presidential address to the British Assn. at the recent meeting at Dover, on the development of the theoretical and applied science during this century and the material, intellectual, social and political influences which this development has wrought in human affairs.—Lond. *Elec.* and *Elec. Eng.,* Sept. 15.

ELECTRO-CHEMISTRY AND BATTERIES.

Electrolytic Treatment of Solutions Containing Copper and Gold.—ROVELLO.—He devised an electrolytic method, using a cell, the anode of which is made of the precipitating metal, and is in an acid solution, and the cathode is any metal that is not attacked chemically by the solution to be treated, in which it is suspended; the anode and cathode are connected by an external wire, and no external course of current is used; that is, the cell is a short-circuited battery. The form of the apparatus is described as follows: In a large trough there are suspended the vertical cathode plates, and above them upon wooden bars there are placed horizontal ingots of the anode metal precipitant. The solution to be treated is supplied through a hole in the bottom into the trough, while the treated solution can flow off at the top. The operation is begun by filling about half the trough with dilute acid and then adding slowly, through the hole in the bottom, the solution to be treated. This solution is heavier than the dilute acid, and therefore rests at the bottom. As soon as it reaches the horizontal ingots, a current goes through the solution from these ingots as anode to the cathode plates below; the solution is decomposed, the metal deposited on the cathode while the acid goes to the anode and forms a salt solution, which flows off. For the treatment of copper solutions, copper is used for the cathodes, iron ingots for the anode; 15 grams of copper can be deposited per square meter of cathode, per hour. For the treatment of auriferous solutions the cathodes are of lead and the anodes of zinc.—*Rassegna Mineraria,* April 21; abstracted in *L'Eclairage Elec.,* July 15.

Aluminium Anodes for Converting Alternating Into Continuous Currents.—NORDEN.—A very long article on the phenomena occurring at the aluminium anode. When an electrolytic cell has one electrode of aluminium, the current passing through it is largely decreased, if the aluminium is the anode, while when the aluminium is the cathode there is no such abnormal phenomenon. With sufficient cells having aluminium anodes connected in series, a current could be diminished to practically zero. If alternating currents are sent through such a battery, only the currents for which the aluminium plates are cathodes, can pass through the battery, and the arrangement can be used to convert alternating into a continuous current, as was described before in the Digest. In the long first part of his article he gives what seems to be a very full account of the former researches of other investigators on this phenomenon; in the second part he describes his own experiments which were made to investigate the peculiar films covering the aluminium anode; these experiments are of a purely chemical character, and therefore cannot be described here. He finds that the chemical reactions occurring at the aluminium anode are very complicated—*Zeit. fuer Elektrochemie,* Sept. 7, 14.

Determination of Lead.—HOLLARD.—An article giving a description of an electrolytic method of determining the lead in its most important alloys. It is based on the determination of the peroxide of lead which is deposited on the anode in exact conformity with the chemical formula; the method is very precise and simple, provided such factors as the current, concentration of the electrolyte, etc., are properly chosen.—*Elektrochem. Zeit.,* July.

REFERENCES.

Electrolysis of Sulphate of Copper.—FOERSTER.—A French abstract of an article, published in 1896, on the influence of the temperature of the electrolyte upon the quality of the electrolytic copper. (Two later papers of Foerster on the electrolysis of copper sulphate solutions were noticed in the Digest June 17 and Sept. 2.)—*L'Eclairage Elec.,* July 8.

Electrolysis of the Bromides of the Alkaline Earths.—SARGHEL.—A very long account of what seems to have been a very extended and careful investigation of the electrolysis of the bromides of calcium, magnesium and baryum. The results are given in a large number of tables. No general conclusions are drawn.—*Zeit. fuer Elektrochemie,* Sept. 7, 14.

Analysis of Copper Slimes.—An abstract of the French article, mentioned in the Digest Oct. 22, 1898, on the analysis of slimes in the electrolytic refining of copper.—*Elektrochem. Zeit.,* July.

Spark Coil Batteries for Automobiles.—Three communications on the question of what class of battery is to be preferred for the spark coils used on oil motor carriages, one recommending a primary battery of zinc and carbon plates in a bichromate solution, another Lessing's dry cell, the third a secondary battery. Methods of testing the capacity are described.—Lond. *Elec. Eng.,* Sept. 15.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Magunna Meter.—BUNET.—An illustrated description of this new form of meter, based on the same principle as the ballistic galvanometer. If a current I of a very short duration passes through a ballistic galvanometer during the time dt, the deflection is proportional to Idt and also to the field, hence proportional to $Iidt$, if the field is proportional to a current i, the period of oscillation being independent of the amount of deflection. The power being measured by the deflection, the meter must be so arranged that I is proportional to the current and i to the e. m. f. of the given current. The meter therefore consists of an electrodynamometer with a series and a shunt coil, one of them having a long needle. In the state of rest the axes of the two coils are perpendicular to each other, and the end of the needle rests on a contact through which the current goes into the coil. The coil holding the needle can revolve around an axis perpendicular to each of the fields while the other coil is fixed. If a current goes through the needle into the coil, the latter is deflected and the current is broken; the needle goes back, closes the circuit again, and so forth. An adjustable weight on the needle enables the adjustment to be made. The movement of the needle from the rest to the maximum deflection, is transferred to a dial which registers the sum of all the angles. The meter does not seem to have been introduced in practice yet.—*L'Ind. Elec.,* Aug. 25.

Meter.—BLONDLOT.—A brief reply to the request for further information concerning his meter made in the conclusion of the description in *L'Ind. Elec.,* July 25 (see Digest, Sept. 23). He states that the resistance of his meter for 10 amperes is about 0.1 ohm, which is about the same as that of the Thomson meter of the same capacity; the loss of voltage is therefore the same in both, but the loss of energy is less than in his, as there is no shunt current. The two coils are connected in series and the self-induction does not affect the correctness of the indications, which remain mathematically exact even for alternating currents; the coefficient of self-induction is less than 0.00078 henry. Concerning the correctness at very small currents he states that the meter will operate with 0.3 ampere, and the error then is only 5 per cent. The tests which he has made at the central station has shown that the instrument is a practical one. He suggests that the application of oscillatory movements to the measurement of electricity, may bring about a revolution comparable with that which the same principle has accomplished in the measurement of time.—*L'Ind. Elec.,* Aug. 25.

Testing Dynamos.—DETTMAR.—A continuation of his long discussion with Fischer-Hinnen (Digest, June 24, July 29, Sept. 16) on the statement of the latter that the friction loss at a constant speed increases quite rapidly with the excitation. He describes the following experiment. In an eight-pole motor he produced a strong magnetic pull by exciting all but one pole. By changing the pole which was not excited, he changed the direction of this pull and found there was not the least difference in the consumption of energy by the motor. He concludes that his former statements are correct for dynamos built by him, but does not draw the same conclusion for dynamos built by Fischer-Hinnen, so that the latter's statement may also be correct; but he would like to know the reason of this differ-

ence. He does not agree that the facts given by Fischer-Hinnen in his last communication are conclusive.—*Elek. Zeit.*, Sept. 7.

Magnetic Influence of Overhead Trolley Lines on Observatories.—WAECHTER.—An illustrated article describing the method used in Strassburg, Germany, to prevent the currents in the overhead trolley lines from having any magnetic influence on the Physical Institute of the University. For the line in the neighborhood, a second overhead wire is used for the return current; a part of this line is single track, but cars run on it in opposite directions; a separate pair of overhead wires are, however, used for the cars running in each direction, so that there are four overhead wires there for a single track. This method is said to have proved to be quite successful.—*Elek. Zeit.*, Sept. 14.

Wehnelt Interrupter.—An account of a series of experiments made with the Wehnelt interrupter. If a magnetic field is produced perpendicularly to the direction of the current in the interrupter, it tends to increase the sparking distance of the secondary, which distance grows with the rapidity of the variations of the primary current.—*Atti della R. Acc. della Science di Torino, Avril;* a French abstract in *L'Eclairage Elec.*, July 8.

REFERENCES.

Voltage of Induction Coils.—OBERBECK.—A French translation in abstract, with the diagrams, of the article abstracted in the Digest, May 13. (See also Digest, May 27).—*L'Eclairage Elec.*, July 15.

Method of Measuring Resistances.—WEBER.—An abstract, with a diagram, of the article mentioned in the Digest Sept. 30.—*Elek. Zeit.*, Sept. 14.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Electrical Signal System for Battleships.—RAPS.—A long, well illustrated paper read before the electrotechnical society of Berlin, describing a large number of instruments, constructed by Siemens & Halske, for local signals on battleships, such as those from the bridge to the engine room, for instance. The essential part of all of the instruments, is a "six-coil motor," each pair of opposite coils of which are connected at one end to the three contact points of a commutating switch, and at the other and through a common return, including the source of current, to the centre of the contact lever of this switch. The six coils are arranged in a circle, the iron cores having pole-pieces radiating toward the centre, leaving an open circular space in which the armature moves. If the contact lever of the commutator switch is moved, the armature in the six-coil motor moves in the same direction. The force acting on the armature is very large and a strong current can be used, as it flows only momentarily. This system has not the disadvantage of the others in which the indications of the instruments are dependent on the currents in divided circuits, and in which, if the insulation of one of the branches should change by accident, there would be wrong indications; he thinks that is the reason why the instruments for electrical signals on the United States battleships in the last war with Spain did not prove satisfactory. A number of special forms of instruments based on this principle are described and illustrated; such instruments are now in use on 15 German battleships and have so far proved quite satisfactory.—In the discussion which followed Arldt pointed out that if these instruments fall out of step by accident, they will continue to give wrong indications; he admits that they can easily be brought into step again. He described the revolving field signal instruments of the General Electric Co., of Berlin (see Digest, Sept. 18), which have not this disadvantage.—*Elek. Zeit.*, Sept. 7.

Wireless Telephony.—A short note on experiments with wireless telephony which have been carried on by Preece near Carnarvon, England. Two sets of four high poles each were erected at a distance of a half-mile apart; half a mile further was a high pole supporting a coil of wire, one end being anchored in deep water. Between these points he succeeded in "transmitting the sound" of a succession of taps through the ether. These taps were made with the view of sending messages by the Morse Code. Messages have been sent without interruption for several days. No technical particulars are given.—*Industries and Iron*, Sept. 15.

American Apparatus for the Windsor Castle, England.—A short note stating that the contract was recently awarded for supplying this residence of the Queen with a regular domestic electric fire alarm system, and that the boxes, bells and special appliances for this installation were ordered from American manufacturers, who furnished them at a lower cost than English makers could.—*Can. Elec. News*, September.

REFERENCES.

Wireless Telegraphy.—An article describing the preparations for the installation of wireless telegraphy on the Marconi system, for the meeting of the British Assn. in Dover.—Lond. *Elec.*, Sept. 15.

Wireless Telegraphy.—BROCA.—An article discussing the coherer and the vertical wire.—*Rev. Gen. des Sc.*, July 15.

Wireless Telegraphy in the English Naval Manoeuvres.—A reprint of the two articles mentioned in the Digest Sept. 23.—*Sc. Amer.*, Sept. 23.

Long Distance Telephony.—A short article of a general nature, discussing briefly the use of two wires instead of one, the transposition of both wires, and the use of No. 8 hard drawn copper wire for toll lines.—*Sc. Amer. Sup.*, Sept. 23.

Telephone Central Station.—An illustrated description of the new telephone central station in Namur, Belgium.—*L'Elec.*, Aug. 26.

MISCELLANEOUS.

Electrical Engineering in England and Switzerland.—An editorial pointing out that engineering cannot be as cosmopolitan as pure science, as engineering work is to a great extent dependent on local conditions, both natural and engendered by the habits, customs and mode of life of the inhabitants of the country in which it is executed. The main difference in the electrical engineering practice in England and Switzerland is that England can be considered as the home of continuous current and Switzerland as the home of alternating current; in England the energy being almost exclusively derived from coal, in Switzerland from water power. In Switzerland the greater the possible output, the lower are the costs per kw of maximum demand; it is the maximum power that the owner of the central station has to pay for, not the energy which he utilizes. It is thought surprising that more attention has not been directed there to accumulator systems, for when additional energy during the periods of small demand costs practically nothing to generate, a slight decrease in the cost of storage batteries would render them a most serviceable agent in increasing the useful capacity of a station. There is only one large storage battery manufactory in Switzerland, and the use of accumulators in water-driven generating stations is rare. Two and three-phase systems are now to be introduced on a large scale in England; but there is an important difference in power transmission and distribution between England and Switzerland, as in Switzerland overhead lines are looked upon as a matter of course for long distance and high pressure work, while in England underground distribution is usual and partly required by law.—Lond. *Elec.*, Sept. 15.

Industrial Deadlock in England.—An editorial discussing the present condition of the electrical industry in Great Britain, especially the fact that English electrical manufacturers are slow in filling orders, and in some cases have been many months behind the specified terms. This is said to be the result of the very rapidly growing demand of electric machinery for tramway work, which has found the English works totally unprepared to meet, so that there is now a large importation from the United States. American firms furnish the machines from stock, English firms have to design them first and make them specially.—Lond. *Elec. Rev.*, Aug. 25.

Scarcity of Paraffine Wax in England.—A short note discussing the prevailing scarcity of paraffine wax in England, which seems likely to become a matter of some seriousness to the makers of electrical conductors, the requirements now amounting to double the available supply. "One has to look for a remedy for the present situation by endeavoring to cultivate the importation of American wax to this country. We are not aware what may be the difficulties, if any, standing in the way of such a development, but we should think it would be worth the while of American traders to give the matter attention."—Lond. *Elec. Rev.*, Sept. 15.

Electricity in Japan.—A note on the rapid development of the use of electricity for lighting, tramways and power purposes and for telegraphy and telephony service in Japan. Large importations are made into Japan, especially of American electrical apparatus. The following data are taken from the *Journal of Commerce.* The value of the importation of dynamos and other electrical apparatus from the United States was $67,000 in 1895, which increased to $680,000 in 1897; from England $175,000 in 1895 and $185,000 in 1897; from Germany $41,000 in 1895, $167,000 in 1897.—*El'ty*, Sept. 20.

Calcutta.—A short note stating that there is now a great demand growing in Calcutta, India, for electric traction and lighting machinery and apparatus.—Lond. *Elec. Eng.*, Sept. 15.

Copper Production in the United States.—An editorial note stating that the reports of copper production in the United States in August

show only a moderate increase over preceding months of the current year, although the total of 22,686 long tons is greater than that for August, 1898, by 3178 tons, or 16.3 per cent. Considerably over one-third of this increase comes from small mines and from smelters which produce some copper from ores which are worked principally for their value in other metals. There has been for the eight months of this year ending with August, a very substantial gain in the consumption of copper in the United States, the exports having decreased 20,420 tons, or 21.5 per cent. for the eight months, which would show approximately an increase in consumption in this country of 32,879 tons, as there has been no increase in stocks, but rather a diminution.—*Eng. and Min. Jour.*, Sept. 23.

Electric Gong Buoys.—Hamilton.—A communication proposing to run a submarine cable from some suitable place near Halifax, about 12 miles out to sea and to connect with it three buoys, each being fitted with an electric motor and other apparatus, such as bell, hammer and switch, for producing signals. One of these buoys could be fitted, in addition with a Marconi transmitter of sufficient efficiency to admit of signals being projected for a distance of about four or five miles from the outer buoy. It is claimed that their maintenance would cost considerably less than that of a lightship and the results would be more satisfactory.—*Can. Elec. News*, September.

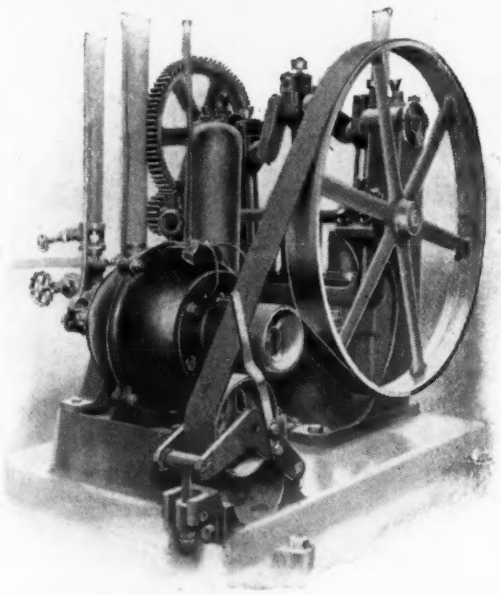
Resistance of Human Blood.—Turner.—A note stating that he found the resistance to be 550 ohms at 60° F., the blood being freshly drawn (presumably this is the specific resistance). He calls attention to a striking change in the resistance in the case of pernicious anæmia in which the resistance sometimes diminishes to about a half, due probably to an abnormal amount of salts.—Lond. *Elec. Rev.*, Sept. 15.

REFERENCES.

Electric Heating.—Boehm-Raffay.—An illustrated description of some forms of apparatus for electric cooking and heating, especially those of Le Roy and Bidet, Parvillee, and the Alioth Co., all of which have already been described in the Digest.—*Elek. Neuigk. Anz.*, Sept. 1.

Electric Pumping.

While by no means a new departure, the accompanying illustration shows a very practical use to which the Lundell motor has recently been put. The outfit is designed for general hydraulic work in factories, residences, hotels and the water works of small towns. The pump is of the well-known Gould triplex pattern, and is self-contained, compact, durable and takes up but little space.

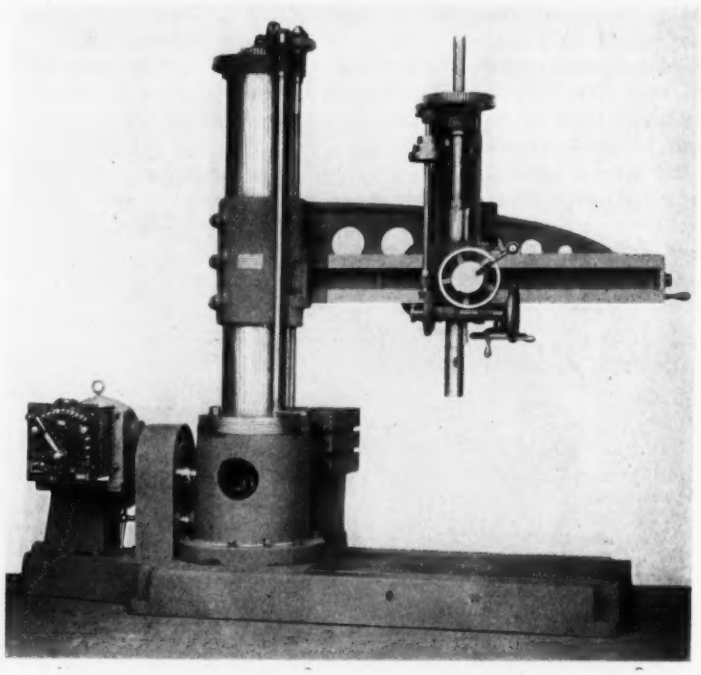


ELECTRIC PUMPING PLANT.

The motor is bolted to the bed plate of the pump, insuring rigidity and ability to withstand the sudden shocks and jars inevitable in such service. Automatic control is effected, depending upon the amount of water in the tank, operating when the water gets low and stopping when it is high. The Lundell motor shown is of the steel clad type and by reason of its simplicity, compactness and immunity from danger is specially adapted to this class of work. It is moisture and dust proof and requires a minimum of attention and if it is desired the motor may be geared to the pump instead of belted. The Sprague Electric Company, 20 Broad Street, New York, manufacture the Lundell motor in sizes from 1-6-hp to 200-hp.

Motor Driven Radial Drill.

The radial drill shown in the accompanying cut is one of a family of five sizes made by the Bickford Drill & Tool Company, Cincinnati, O., to which they have recently applied electric motors. The drills are made in four styles, plain, tapping, half universal and full universals, and may be arranged to receive the motor on



MOTOR DRIVEN RADIAL DRILL.

top of the column or at the base of the machine, as illustrated. The cut shows the No. 2 plain radial fitted with a 2-hp, 115-volt, bipolar round type, Lundell motor, manufactured by the Sprague Electric Company, and with a 116-volt, Cutler-Hammer, variable speed starter.

Arranged in this way, the machine has 20 changes of speed and three changes of feed for each change of speed. The spindle is provided with both hand and power feed and quick advance and return. The arm is raised and lowered by power, by means of a simple mechanism placed within convenient reach of the operator; it is easily swung round, and is quickly clamped. The sleeve or outer column is mounted on a stationary stump, which extends up, and has a bearing near the top of the machine. This is equivalent to a double column and affords a degree of stiffness difficult to attain in other forms of construction.

Franklin Institute Celebration.

The seventy-fifth anniversary of the Franklin Institute, Philadelphia, will be celebrated in the auditorium of the National Export Exposition, this week, under the direction of the several sections of the Institute. The series of meetings and addresses, as thus far arranged, promise to be of unusual interest. The meetings will be held each day at 8 p. m. On Tuesday, Oct. 3, the electrical section will have the floor, when Dr. Edwin J. Houston, of Philadelphia, will give "A Summary of Electrical Progress During the Past Seventy-five Years." Addresses will also be made by Ralph W. Pope and Prof. F. B. Crocker, of New York. The management of the National Export Exposition have extended to the members of the Institute and its invited guests the privilege of free admission during "Institute Week."

Telephone Exchange Protection from Lightning.

One of the most important features of telephone exchange work has been the matter of protection against lightning and stray currents. The North Electric Company, of Cleveland, has recently brought out what it claims to be the first protector in which the action is entirely automatic and in which the parts do not need replacing because of the burning out of the fuses or fusible coils. This equipment is made so that when lightning enters the central office, it is taken to the ground in the usual method by carbon arresters. When a sneak current comes in on the exchange, the lines affected are automatically grounded, remaining grounded until such time as lines have been freed from intrusion. Two important elements are claimed for the protector; first, the action is entirely automatic, both in the matter of grounding the line and of removing the ground connection as soon as the foreign current is taken from the line. Second, there are no fuse coils or fuses burning out and nothing to be replaced. This amounts to a material saving in the course of a year, to say nothing of the preservation of constant working order. A point is also made as to the absence of inductive resistance from the lines, so that the talking is always good and free from inductive effects.

We show herewith, Fig. 1, a front view of three hundred pairs of these automatic protectors mounted on an angle iron rack in connection with a cross connection board. This equipment can, however, be used in all sizes of exchange, the system being thoroughly elastic. An enlarged view of the coils, three-quarter size, is shown, Fig. 2, and a view, Fig. 3, showing the method of mounting strips of fifty pairs each. This equipment is susceptible of extremely fine adjustment, and the North Electric Company claims that this protector used in connection with its system of protecting cables and telephones, results in 90 per cent. of the labor of the inspector and repairman being confined to the central office.

The apparatus illustrated is wholly fire-proof and involves the use of the very best of material and mechanical work. An important feature is the facility offered for testing the line for trouble, testing either to the switchboard, or to the outside line without interfering in any way with the operation of the line. The North Electric Company also calls especial attention to the fact that expensive office terminals for the cables are not necessary where its automatic type of protection is used.

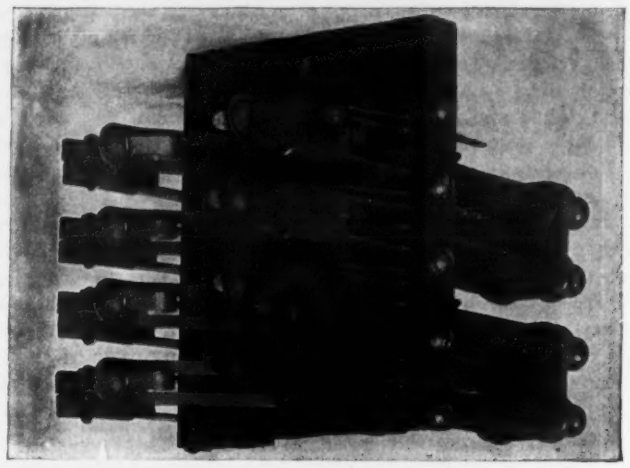


FIG. 2.—¾ SIZE.—HEAT COILS.

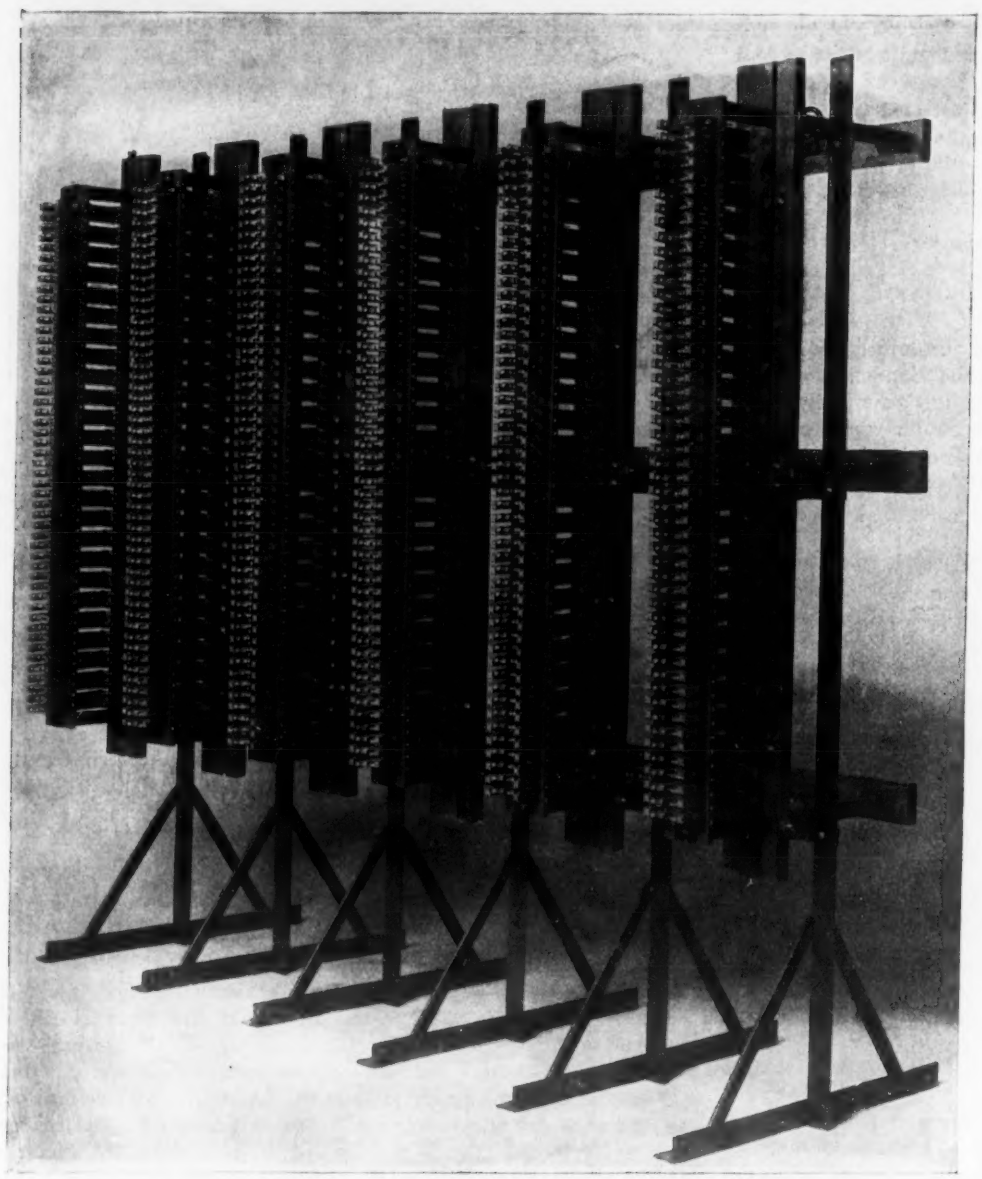


FIG. 1.—300-PAIR PROTECTOR AND CROSS CONNECTING RACK.

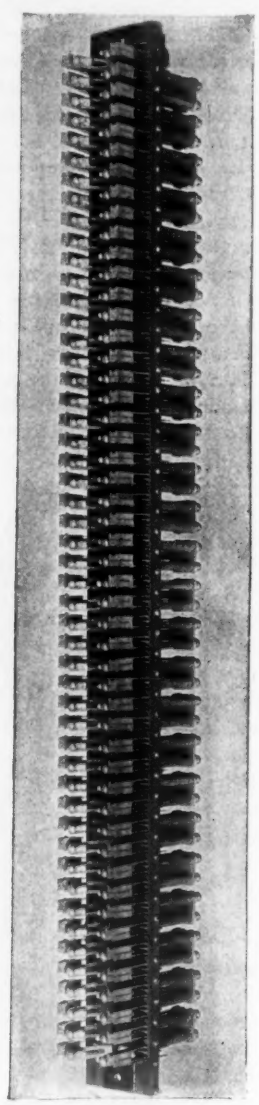


FIG. 3.—STRIP OF COILS.

The Westinghouse Gas Engine.

ABOUT three years ago the Westinghouse Machine Company announced that after some years of experimental work it had completed a new type of gas engine for manufacture in all sizes. Since then a large number of these engines have been supplied for electrical generation, several of the plants in which they have been used having been described in our columns. We are now enabled to print a detailed description of the engine, and include a complete view of the largest size now made—a three-cylinder engine of 650 brake hp, which has been in successful operation for more than a year, and is the largest gas engine ever built.

As will be noted from these illustrations, and more particularly from Fig. 2, the machines in their general appearance bear a marked resemblance to the Westinghouse steam engines. They are built in two-cylinder and three-cylinder patterns, the former in sizes up to 70-hp, and the latter from 15-hp up to the largest powers desired.

The two-cylinder engines receive an impulse at every revolution, and the three-cylinder engines an impulse for every two-thirds of a revolution, resulting, of course, in a superior smoothness of operation as compared with the ordinary single cylinder engine, which receives at most one impulse at every second revolution. Over a range covered by both patterns, i. e., from 15-hp to 70-hp, inclusive, the manufacturers state that the choice between the two-cylinder and the three-cylinder engine is largely a matter of individual preference. For a given power the head room required by the latter is considerably less, its parts are smaller and more easily handled, and for equal uniformity of rotation its fly wheels are lighter.

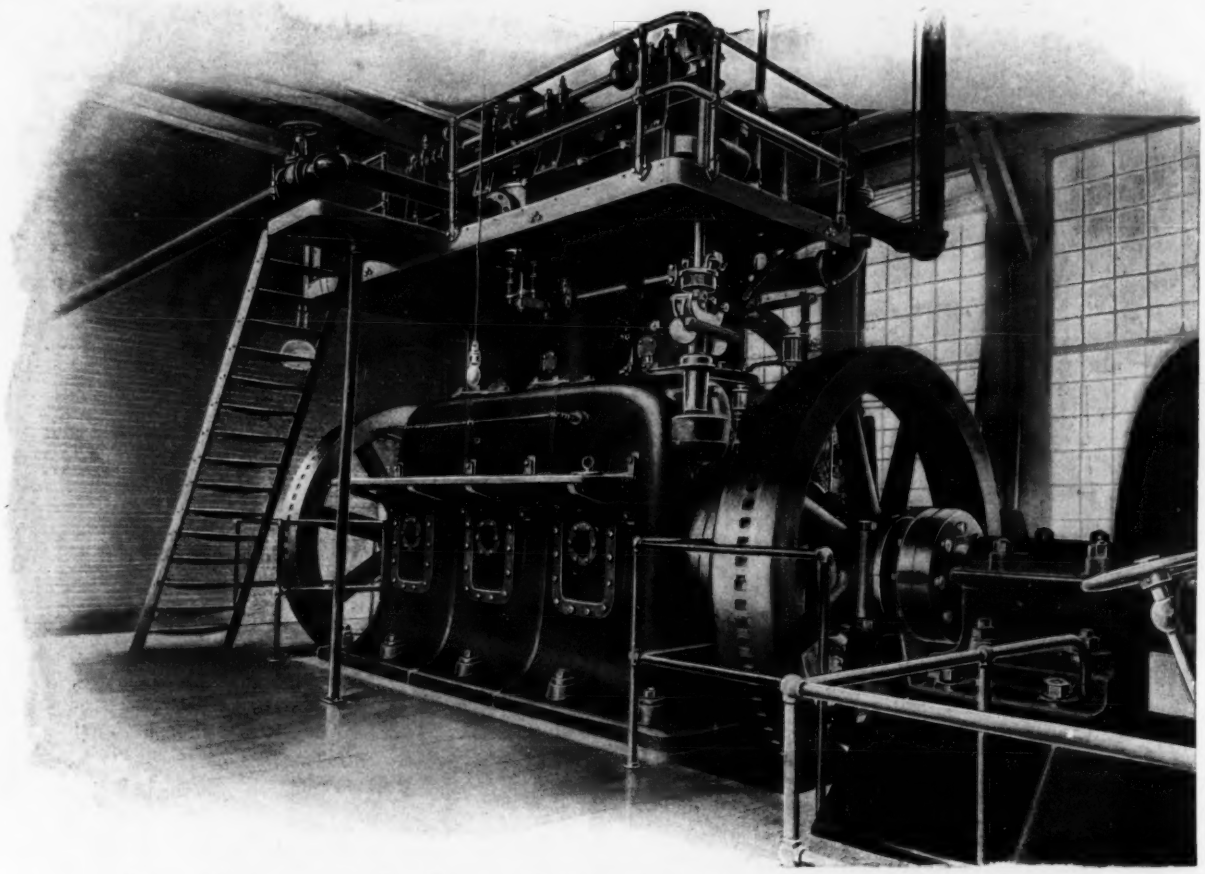


FIG. 1.—WESTINGHOUSE GAS ENGINE, THREE-CYLINDER PATTERN, 650 BRAKE HORSE-POWER.

Fig. 2 shows a section through one cylinder of a three-cylinder engine, all three being exactly alike. The illustration and description will apply with sufficient accuracy to the two-cylinder engine as well, although the mechanism for actuating the inlet valves and igniters is somewhat differently disposed in the latter.

The cylinders are mounted on an enclosed crank case, the distinguishing feature of the Westinghouse single-acting steam engines, which forms the base or frame of the engine, and serves as a receptacle for the oil which lubricates the cranks and upper journals of the connecting rod. The engine is single-acting, a feature necessary in a gas engine, for the reason that stuffing boxes and piston rods deteriorate too rapidly when the latter are exposed for half the time to an atmosphere of burning gases.

A simple trunk piston of generous length, carrying a hardened steel wrist pin, which is linked to the crank by the connecting rod, comprises the mechanism for transforming the intermittent pressures on the top of the piston into rotary motion at the shaft, in this respect not differing from the most elementary steam engine.

This engine operates on the usual four-stroke cycle, which will be considered in detail later. Briefly, during one revolution the engine acts as a pump to supply itself with fuel, which it utilizes running as a single-acting pressure motor during the next succeeding revolution. The valves and the igniters pertaining to each cylinder have therefore to perform their functions once for every two revolutions of the crank, instead of once for every revolution, as in the steam engine. Consequently the cams which operate these parts—cams being used in preference to eccentrics by reason of their more prompt action—must be mounted on shafts running only half as fast as the main shaft, and a train of gears is the only positive means by which this reduction of speed can be made, and this is the sole object for its introduction.

Referring again to Fig. 2, *A* is the shaft which carries the exhaust valve cams, and is driven by gears from the main shaft. Each exhaust cam works against a roller carried on the free end of the guide lever, *G*. The exhaust valve, *E*, has a long stem projecting downward and resting on a hardened steel plate on the upper side of this guide lever. The spring surrounding the stem serves to hold the exhaust valve to its seat and the stem in contact with the guide lever. From the exhaust cam shaft, *A*, a horizontal shaft with bevel gears leads to the opposite side of the engine, engaging with a vertical shaft which in turn drives the upper cam shaft, *B*. Incidentally, the vertical shaft carries the governor. The upper cam shaft carries two cams for each cylinder. One engages against a roller on the end of the horizontal lever, *C*. As the throw side of this cam comes uppermost, the opposite end of the lever, *C*, depresses the stem of the inlet valve, *J*, opening the latter for the admission of the mixture of gas and air. A spring on the stem of the inlet valve furnishes a means for closing it and keeping the cam and roller always in contact with each other. Immediately adjacent to the inlet valve cam is the igniter cam, which at the proper instant operates a horizontal plunger working through the guide, *D*, to break the electric current through the wire, *S*, at the terminals of the igniter, *F*.

The cylinder heads and the upper end of the cylinder are thoroughly water-jacketed, as, owing to the extreme heat to which these parts are subjected, they would soon become red-hot if no means

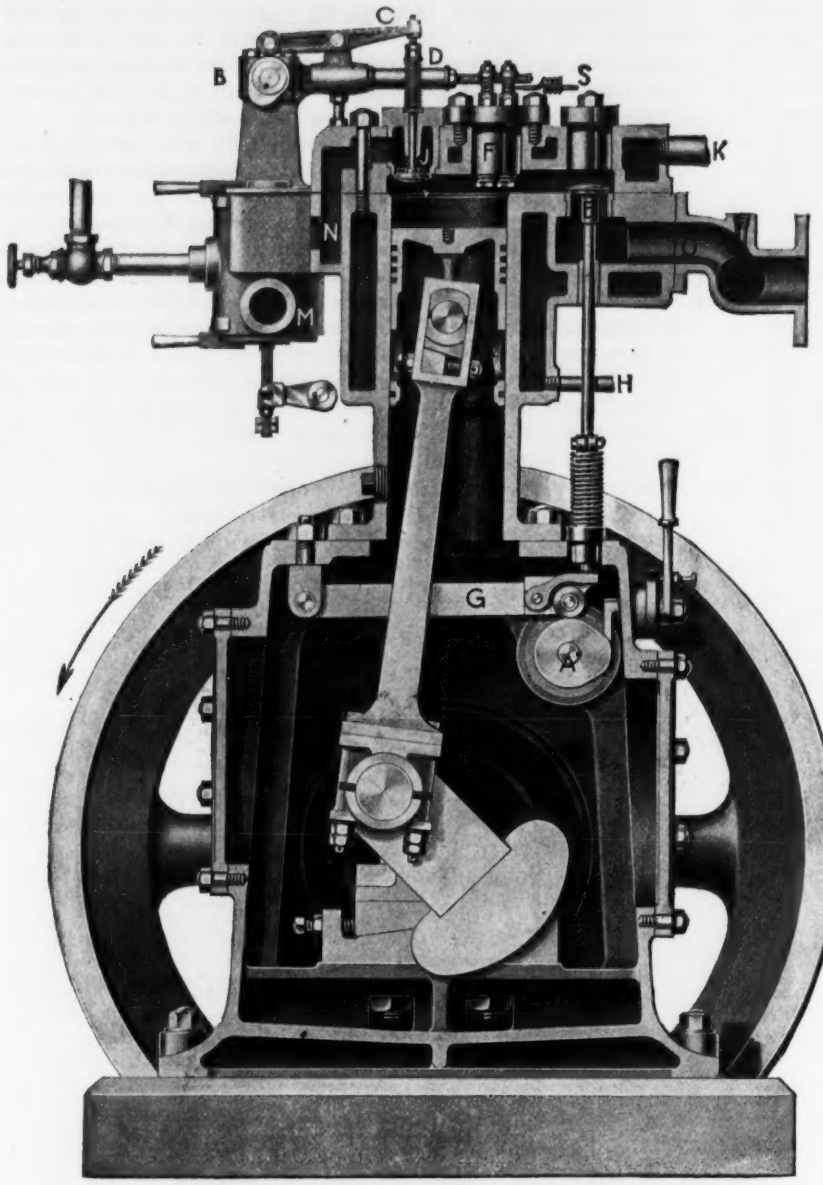


FIG. 2.—CROSS SECTION THROUGH CYLINDER.

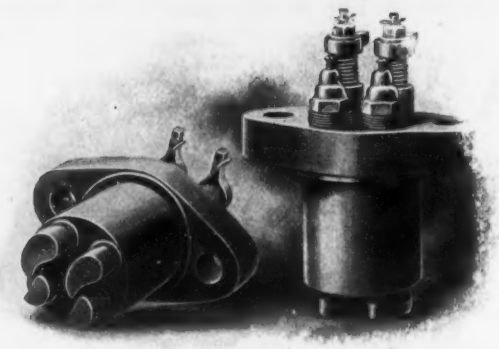


FIG. 4.—IGNITER.

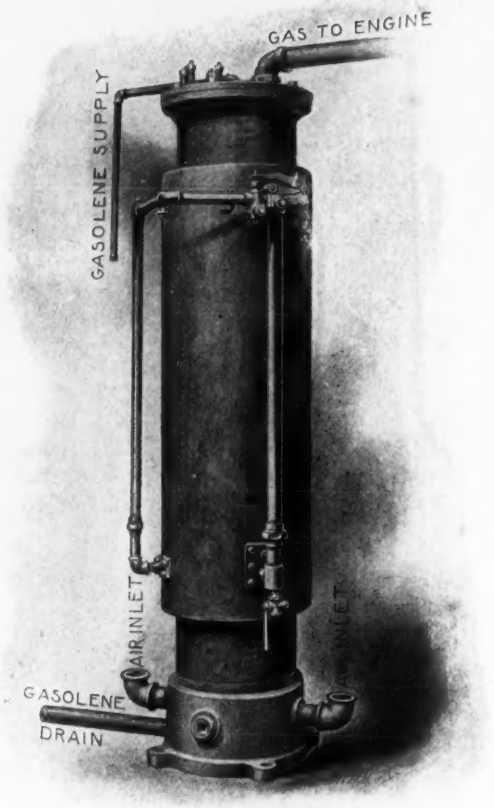


FIG. 5.—GASIFIER.

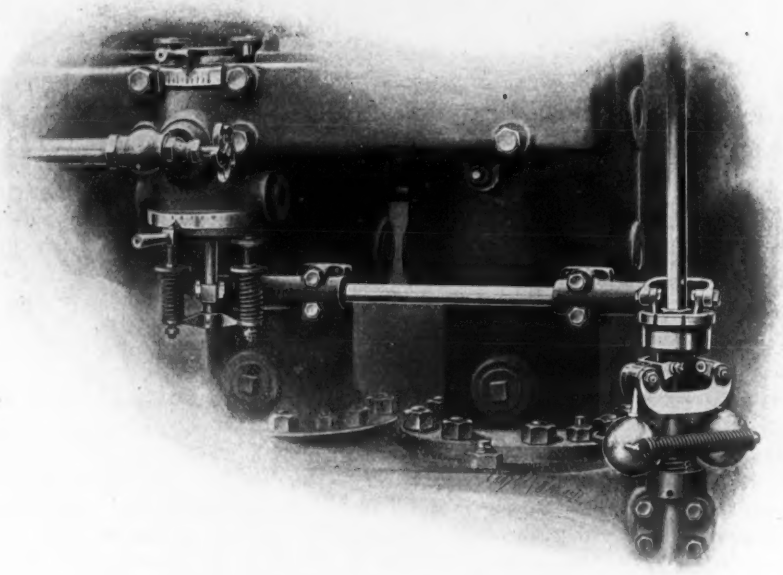


FIG. 3.—GOVERNOR OF THREE-CYLINDER ENGINE.

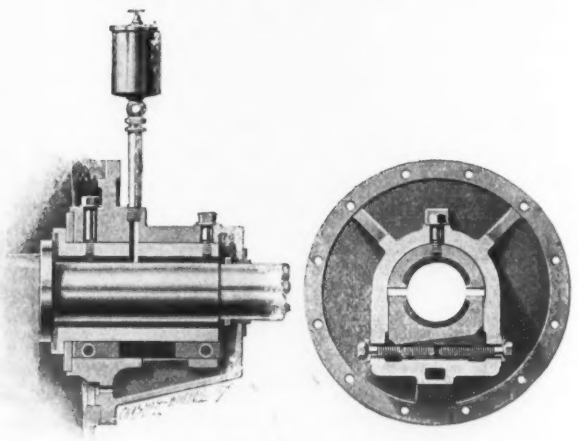


FIG. 6.—MAIN BEARING.

DETAILS OF WESTINGHOUSE GAS ENGINE.

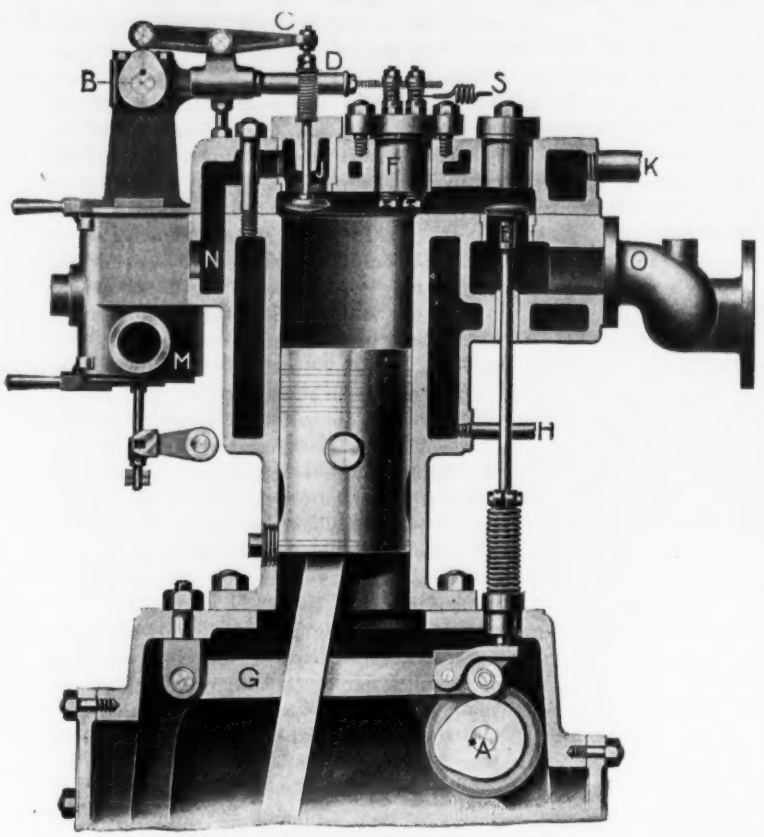


FIG. 7.—INDUCTION.

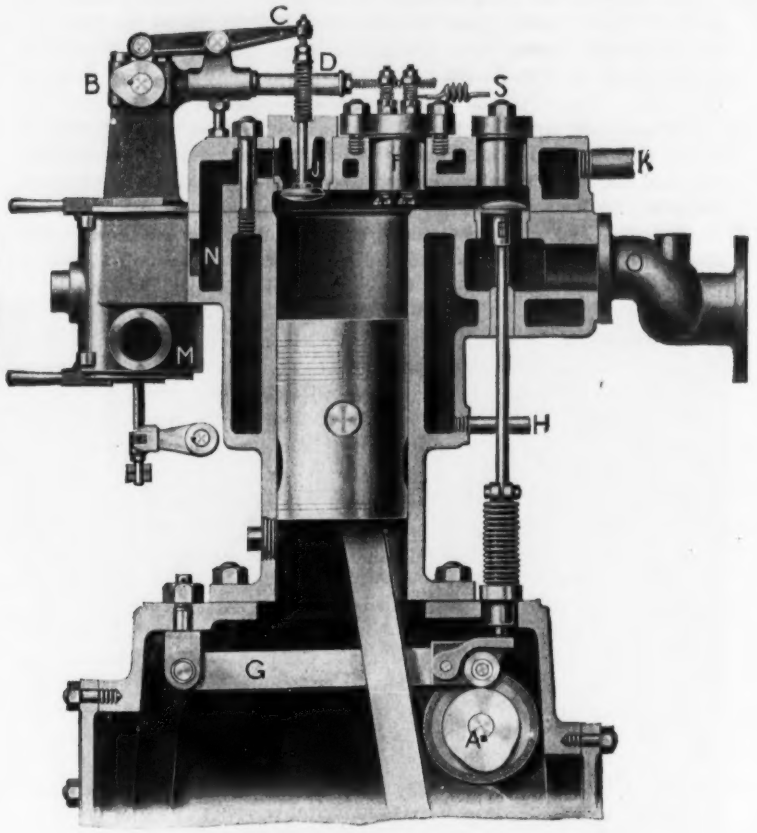


FIG. 8.—COMPRESSION.

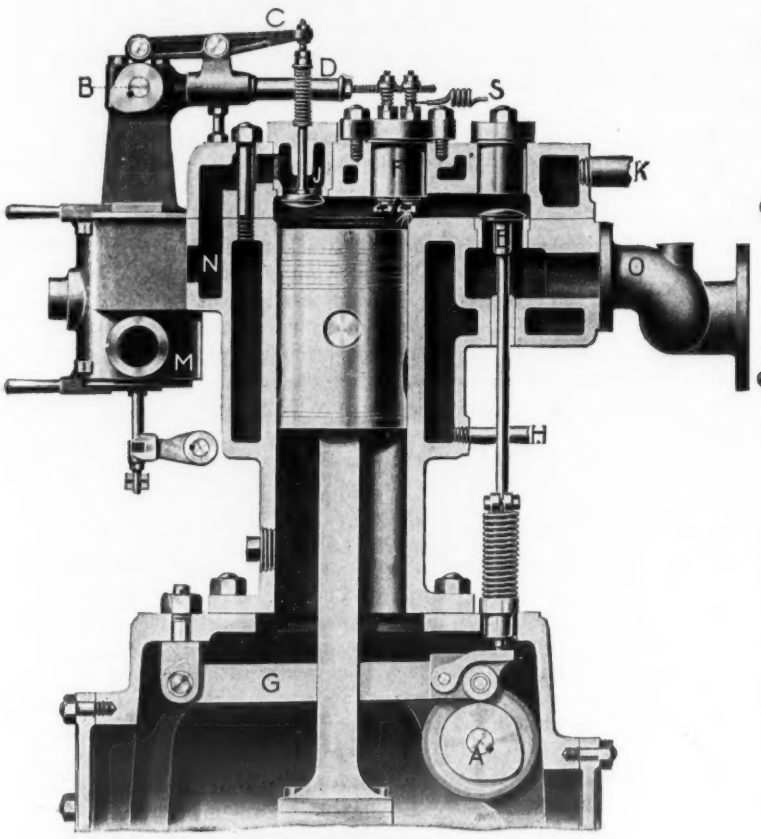


FIG. 9.—IGNITION AND EXPANSION.

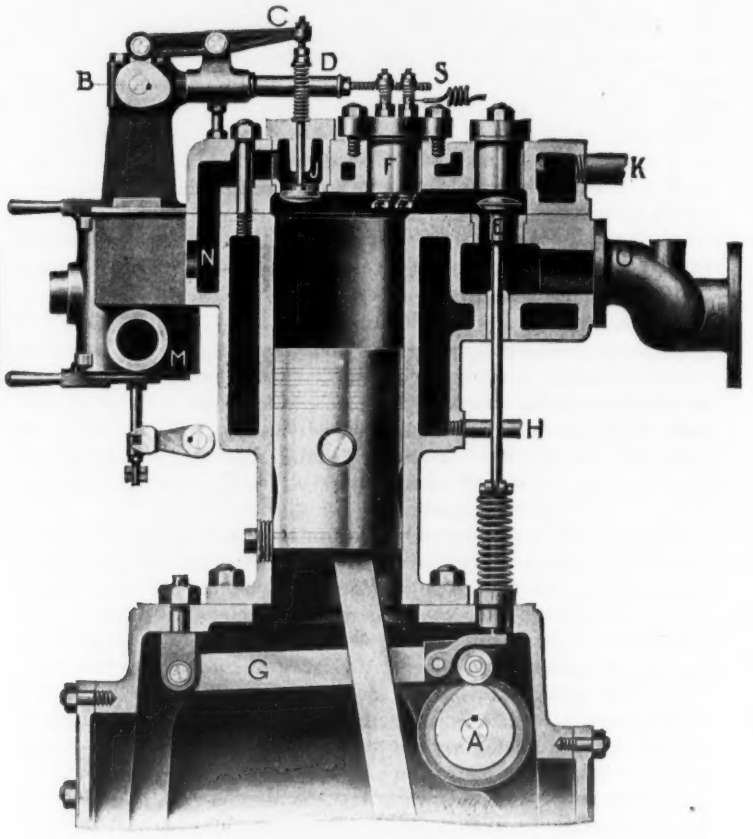


FIG. 10.—EXHAUST.

ILLUSTRATING THE SEVERAL OPERATIONS OF A CYCLE.

were provided for keeping the temperature down. The cooling water enters at *H*, and is discharged at *K*.

Figs. 7, 8, 9 and 10 will serve to illustrate more clearly the four parts of the complete cycle of operations, the details of the cylinder and valve gear being on a somewhat larger scale, and the relative positions of the valves, etc., are shown separately for each part of the cycle. The reference letters are the same as in Fig. 2.

The gas and air enter the mixing valve chamber, *M*, by separate inlets, in proportionate amounts which can be fixed by the attendant, and the mixture is conducted through a distributing chamber to the port, *N*, leading to the cylinder head, in which the inlet valve is located. The mixing valve is not shown in section, but is referred to more at length under the paragraph relating to regulation. The four operations of the cycle are as follows:

1. (Fig. 7) The piston is on its downward stroke, the inlet valve, *J*, is open, and the charge of gas and air is being drawn into the cylinder. The exhaust valve, *E*, is closed, and the inlet valve will close just as the piston reaches the limit of its downward stroke.

2. (Fig. 8) The piston is on its upward stroke, both valves are closed, and the charge of gas and air is being compressed into the clearance space.

3. The piston (Fig. 9) has reached the upward limit of its compression stroke, the crank is just passing its upper center, and both valves are still closed. Shortly before this the igniter cam has brought the igniter terminals in contact, completing an electric circuit. Just at this instant it releases them, and they fly apart, actuated by a coiled spring located in the guide, *D*, breaking the circuit and forming a spark which ignites the charge. An immediate rise of pressure occurs, and the piston is forced downward by the expansion of the burnt gases, both valves remaining closed until just before the completion of the stroke, when the exhaust valve, *E*, opens.

4. The piston (Fig. 10) is ascending, forcing out the spent gases through the now open exhaust valve, *E*, and the exhaust pipe, *O*. The exhaust valve closes as the piston completes the stroke, bringing everything in readiness to repeat the cycle.

The connecting rods are forged from open hearth steel. The crank pin end is made on the pattern universally used in marine engine work. When the engine is running the connecting rod bolts dip into the oil in the crank case just far enough to submerge the lower nut on each bolt when the crank is on its bottom centre, by reason of which a generous supply of oil is dashed over all the internal working parts. Enough oil clings to the sides of the cylinders and piston to lubricate these parts also, no special cylinder oil whatever being required. This in itself is an economic feature of no inconsiderable importance. The upper end of the connecting rod is fitted with phosphor bronze boxes having the usual wedge arrangement for adjusting. By reference to Fig. 2 it will be seen that there is a hole in the wall of the piston directly opposite the wedge screw, and when the crank is on its lower centre this hole registers exactly with a hole in the side of the cylinder, which is closed by a screw plug. By removing this plug the wedge bolt and its jam nut are readily accessible for making any needed adjustments by means of an ordinary socket wrench.

The crank shafts are also of open hearth steel, specially made to specifications. The cranks are fitted with cast iron counterbalances, securely fastened, which contribute to smooth running. In the two cylinder engine the crank arms are parallel with each other. A study of the cycle of operations will show this to be necessary in order that the impulses may occur regularly in one cylinder or the other at each revolution. In the three-cylinder engine the cranks are spaced 120 degrees apart.

The main bearings (Fig. 6) are similar in construction to those in the Westinghouse single-acting compound steam engines. They are supported in castings which form the ends of the crank case, and are adjustable from the under side by means of wedges and draw-bolts, as shown in Fig. 6. As the wear on the main bearings is always downward, this method of adjustment restores the shaft to its original distance from the base of the engine. This is a particularly desirable feature in an engine direct connected to a dynamo, as the alignment of the engine bearings with the dynamo bearings is thereby preserved. Another point is that the clearance between the pistons and the cylinder heads is maintained at a constant volume, so that the degree of compression is unchanged, and the economic performance as affected by the compression is unimpaired.

The igniter (Fig. 4) is a removable plug fitting in a hole in the cylinder head and secured by two bolts through a projecting flange, carrying the binding posts for attaching the wire which conducts the electric current, and also the mechanism for making and breaking the current to produce the igniting spark.

Except in the smaller sizes, the igniter has two binding posts and two sets of current breakers, one set only being in use at one time. In case of accident or failure of the set in use, the other is in reserve and ready for immediate service. The wire supplying current is connected into the other binding post, and the engine may be run without interruption until it is convenient to shut down long enough to remove the igniter for inspection or repair.

The current for the igniters is furnished by a battery through an induction or sparking coil. The battery is connected up through a three-point switch, so that the direction of the current through the igniting apparatus may be reversed at will. Whenever the terminals on the igniter break the electric circuit, the passage of the spark carries off infinitesimal particles of the substance of one terminal and deposits them on the other, the action following the direction of the current. By periodically reversing the direction of the current, whatever substance has been taken away from one terminal and deposited on the other is restored, and, consequently, the lasting qualities of the igniter are thereby greatly augmented. The battery switch is fitted with a locking device, such that when the battery is cut out, as it should be whenever the engine is shut down, it can only be cut in again in the way that will send the current in the reverse direction from what it was on the previous run.

If a direct current lighting or power circuit be conveniently located, it may be tapped for supplying the igniters, in lieu of a battery, although this is sometimes objected to because the circuit is momentarily grounded every time the igniter terminals make contact. A miniature dynamo is made exclusively for this service, in which case the current being small and nothing else than the igniters being in the circuit, the grounding is entirely unobjectionable.

The inlet valve, J, is mounted in a plug which is inserted and secured in the cylinder head in the same manner as the igniter, making it easily and quickly removable for inspection. A third plug of similar shape, but containing no mechanism, serves to close an opening in the cylinder head immediately over the exhaust valve, through which the latter is readily accessible.

One of the salient features of this type of gas engine is the method of regulation. Instead of governing by the old "hit-and-miss" principle, in the Westinghouse gas engine the frequency of the impulses is the same for all loads, and the relative proportions of gas and air remain constant, but the amount of the charge admitted to the cylinders and the consequent strength of the impulse is graduated exactly to the power required. By this system a regulation is obtained which is claimed to be equaled only by the best types of automatic steam engines.

The governor connections on a three-cylinder engine are shown in Fig. 3. In the two-cylinder engine the governor engages directly with the stem of the regulating valve, while in the three-cylinder engine the governor is located to one side, and its motion is transmitted to the regulating valve through a rock shaft and levers; otherwise the governing mechanism is the same in both types. The gas enters through the pipe and valve shown into what is called the mixing valve chamber. The air supply enters the mixing valve chamber in the two-cylinder engine through an opening on the opposite side, and in the three-cylinder engine through one of two openings located on either side of the gas supply pipe, a little below and at right angles to it. At the top and bottom of the mixing valve chamber are horizontally moving levers with pointers swinging over graduated arcs. The upper lever controls the gas supply and the lower one the air supply. The ratio between the readings on the two scales, with the levers in any fixed position, shows exactly the proportions of air and gas in the mixture supplied to the cylinders. The governor is of the fly ball type, quick and sensitive in its action. As the balls move in or out, with changes of load, the regulating valve moves up or down, increasing or decreasing the quantity of the mixture with the greatest nicety and without altering its quality.

A notable feature of the governing apparatus is that it enables one to determine accurately the best proportions of air and gas to use. When the engine is running on a steady load, if one mixing valve lever is moved backward and forward while the other remains stationary, the regulating valve stem will be seen to move up or down as the mixture becomes less or more efficient, indicating that a greater or less quantity is being used. Starting with too little air and gradually increasing it, the regulating valve will move gradually down until the mixture of maximum efficiency is reached, and if the

air supply be still further increased, the regulating valve will begin to open again. It will thus be seen that the proper quantity of air to be used with any grade of gas becomes a matter of exact measurement, instead of individual judgment.

For using gasolene the only special construction in the engine is that the clearance is increased so as to give less compression. The gasolene gas, being more inflammable, will not stand as high a degree of compression as natural gas or ordinary illuminating gas. The gasolene engine, moreover, will operate perfectly from a mechanical standpoint on natural or illuminating gas, but with a slightly lower efficiency than if the compression were brought up to the same point as on engines supplied for using these fuels regularly. In some instances, where the gas supply has been irregular or uncertain, the gasolene outfit has been installed, using the gasolene gas only in cases of emergency, a slight sacrifice of efficiency being made for the sake of being able to change from one source of fuel supply to the other without stopping.

The gasifier is a simple piece of apparatus with no mechanism about it liable to become deranged. Its general appearance is well illustrated in Fig. 5. It consists of an upright cylinder of heavy iron pipe closed at both ends and surrounded by an iron casing forming a water jacket. The gasolene supply is located on a lower level, at any desired distance away, and is supplied to the gasifier by a small pump through a one-half inch pipe entering at the top. On its way down it passes through a spraying device which keeps it in a finely divided state, and such amount as has not been converted into gas is immediately, on reaching bottom, drained back to the source of supply. A gas connection leads from the top of the gasifier to the throttle of the engine, and air inlets are provided at the lower end. The suction of the engine when running draws air into the gasifier, which passes up through the descending current of gasolene spray, and by the time it reaches the top a gas of exceptionally excellent quality has been formed. To replace the heat absorbed in evaporation, part of the warm water from the cylinder jackets is circulated through the jacket surrounding the gasifier, the amount being automatically regulated by a simple themostat in the latter, so that a constant temperature is maintained irrespective of the load on the engine and consequent rapidity with which the gas is being generated.

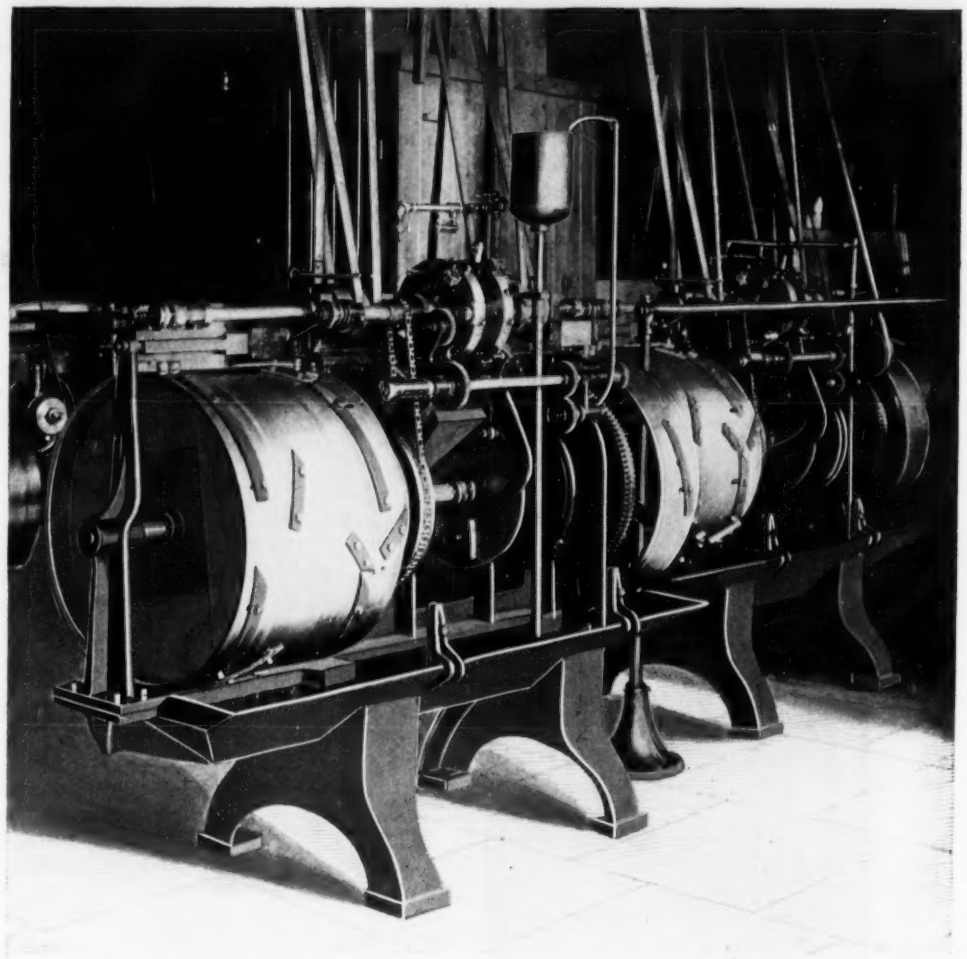
Automatic Vertical Double Turret Screw Machine.

An ingenious automatic screw machine is shown in the accompanying illustration, twenty of which are in use in the works of the Western Electric Company, in New York. By means of this machine, material for screws, binding posts, etc., of any special form is fed into the machine in the shape of a rod, and an entirely finished piece of work drops from the machine. There are two spindles, called the primary and secondary; the former receives the rod, and the latter grasps the piece of work after all operations on one end have been completed, and carries it back for the operations on the opposite end. There are two vertical turrets, one of which, called the "front," is driven by pins secured in the other, which latter is mounted on a hollow shaft concentric with the shaft to which the first mentioned turret is secured. This method allows the second turret to have an axial motion independent of the first one.

The hollow shaft is connected at the end of the machine to a sliding block, which is gibbed to a projecting arm extending from the rear of the machine over the cam drum; underneath the sliding block is a roller pin, which strikes the cams shown on the drum and set at angles to give a required movement in a given length of time as the drum revolves, which in turn actuates the movement of the front turret. The opening and the closing of the chucks, of both spindles, and the feeding of the rod forward in the primary spindle, is controlled by the cams on the drums at each end of the machine. These cams can be adjusted to feed the rod to any required length.

The pulley whose axis is at right angles to that of the machine, drives, by means of a worm and worm gear, the cam drum shaft, and also leather-covered friction discs which engage with a sprocket wheel, the chain of which advances the turret to a new position. The operation of the machine is briefly as follows:

The rod or bar of stock is fed through the primary spindle, and



SPENCER AUTOMATIC SCREW CUTTING MACHINE.

tightened, as usual, automatically in a chuck. The tools in the forward turret then operate upon it, one after the other. As the turrets revolve they are arrested at the proper position for each tool by stops on the periphery of the turret, which are brought down on a hardened steel rest along which they slide a required distance which is controlled by the adjustment of the cams on the drum. As the work of each tool is finished, the turret moves back until the stop clears the rest, when the sprocket chain advances the turret to the next tool. The cut-off and forming tools operate in the usual way on the cross slide.

When the work to be done by the tools on the forward turret is completed, the secondary spindle, propelled by another set of cams on the rear drum, moves forward, and, revolving at the same speed as the primary spindle, grasps the partially finished piece of work, which is then cut off from the rod, and carried back by the secondary spindle to a position opposite the tools in the rear turret. As the forward turret again moves up to perform the first set of operations on the rod, a second series of operations is being simultaneously performed by the tools in the rear turret on the opposite end of the piece, and a completely finished piece of work, with operations done on both ends, of either threading, drilling or tapping, drops from the machine. After completion of the piece, and before going forward to again receive the work from the primary spindle, the secondary spindle automatically ejects the work.

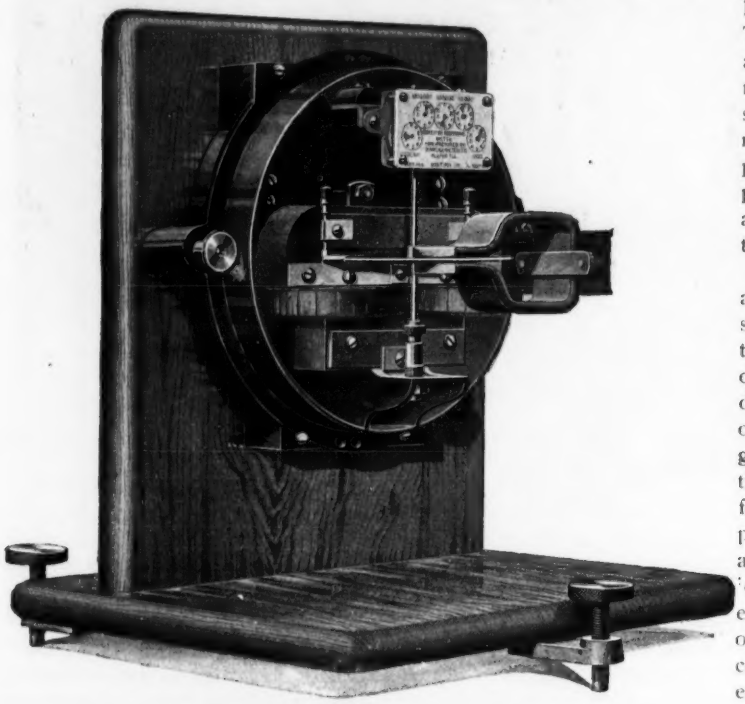
The machine described is manufactured by the Spencer Automatic

Machine Screw Company, of Hartford, Conn., the inventor being Mr. C. M. Spencer, the original inventor of the automatic screw machine, and well known as the inventor of the Spencer repeating rifle.

Scheefer Alternating Current Watt-Hour Meter.

After long experience in the manufacture of alternating current meters the Diamond Meter Company has introduced a new type of meter, which is the result of careful study and experience in the requirements of a simple and correct meter to meet the demands of central stations. The many difficulties encountered in the early use of a wattmeter have, the company believes, been met and overcome in the present meter, which is highly sensitive, accurate and permanent, at the same time simple and inexpensive.

Of the first type of Scheefer watt-hour meter of the inductive type, many thousands were put in practical use, and are still in use with satisfactory results. They had many faults common to meters then in use, and which have been eliminated in the new type, namely: First—That the meter was not dust proof. It is well known that dust is destructive to the delicate action of mechanism, and not only dust, but vapor and moisture corroded the parts, which resulted in the meter losing its sensitiveness in a short time. Second—The next fault lay in heavy moving parts which prevented sensitiveness by the large amount of friction due to the weight of shafts and parts. An attempt was made to overcome this by strong permanent magnets and large damping disk by masking the friction with large eddy



SCHEEFER ALTERNATING CURRENT WATT-HOUR METER.

currents in the disk, but this device proved only temporary, because of the rapid wear of the jewels in consequence of the great weight of the moving parts. Third—The permanent magnets were not really permanent, but lost their magnetism. Electrical faults were those of large shunt loss, large loss in the series coils with consequent large drop in the service, and, not being correct on inductive loads, serious effect in change of frequency and perhaps various other minor faults.

In the present type "D," Mr. Scheefer has adopted the round form, as this allows the case always to fit tight. In order to avoid unnecessary weight, these cases are made of sheet metal. The projecting flange of the meter is made slightly tapering. On this is placed a rubber band over which the case slips. By gently forcing the case over the taper a perfectly airtight joint results. These rubber bands can be renewed at any time by slipping on a new one. The connecting or binding posts of the meter are covered with a fibre bushing and are forced into the meter through holes in the castings, making a perfectly tight fit, as the ends of the binding post are not drilled through, but left closed. They are perfectly tight, and when the case is on the meter it is hermetically sealed and dust, moisture and rust proof. The moving parts consist of a very thin and light aluminum disk with a light shaft, the whole being very stiff and light. The damping disk used in the older form being dispensed with, one disk is sufficient for the meter, and this has resulted in a very important improvement, as its lightness prevents any wear or injury to the jewel and in a much better response to sudden changes of load, to which the parts respond very quickly. Another gain is in the action of the permanent damping magnet. It is well known that large damping disks or heavy eddy currents react on the magnet, in time weakening it. The damping is as well done with the light disk without the injurious results of a larger disk.

As the manufacturing of permanent magnets is now much better understood than formerly, it has resulted in the production of magnets which are perfectly permanent. They are made especially for this purpose from imported steel of the highest grade which is used in the best grade of instruments in Europe. They are perfectly aged and will remain for years without change. The shunt core of the magnetic system is practically closed, thus avoiding the scattering of any lines of force. This has resulted in the highest economy in the use of a shunt current, the loss being ½-watt on 125 cycles and ¾-watt on 60 cycles. As meters are constantly in use, the shunt loss is always continuous, and should be as small as possible. These results are highly satisfactory. Then again in the small use of current the action of the shunt on the moving element is so slight that the effect of vibration is almost nothing, and making the action on the jewel negligible.

The series coils consist of only a few turns of wire without any iron core, and therefore there is no inductive drop and very small loss, the drop through the meter being only about one-tenth-volt. The meter may be overloaded 50 per cent. without any change in accuracy. Because of the absence of iron in the series coil, the meter gives a perfect straight line through its range. It is so constructed that all parts are readily accessible and simple. The jewel may be taken out, inspected and replaced in a few seconds; other parts can be inspected, taken off and replaced with ease and simplicity without changing the calibration of the meter or impairing its accuracy; and there is no complication making it necessary to seal the meter.

The meter is furnished with a compensator for a ready and quick adjustment for very light load, two knurled posts carrying small shields which embrace part of the disk. This causes a slight torque to be given to the disk. One gives a torque towards the left and the other towards the right, and one or the other may be made to predominate. By this means an adjustment is made so that the disk is on a balance and will move with the slightest load, giving a high degree of sensitiveness, and this the meter will retain. If at any time the meter should get sluggish or a want of sensitiveness should manifest itself, all that is necessary is to strike a balance with the compensator, which can be done in a few seconds without disturbing anything, the full load being unaffected. If at any rare time the jewels should become slightly roughened, it will as a rule have no effect on the accuracy of the meter at full or moderate load, but only on a very light load. This can be quickly corrected with the compensator by striking a balance, or new jewels can be quickly and easily replaced without disturbing a single feature of the meter or its calibration.

The meters, which are finished in enamel, are stated to be true wattmeters, registering correctly on any inductive load and being very little affected by frequency.

Series Alternating Lamps at Los Angeles, Cal.

The San Gabriel Electric Company, of Los Angeles, Cal., are putting in the largest alternating current series arc plant yet installed, and will use 850 Manhattan lamps and nine regulators. The operation of the lamp is mechanical rather than electrical, and the loss in the mechanism is said to be but five watts. The mechanism is of the concentric single solenoid type.. It contains absolutely no springs, and is noiseless in operation. The lamp carries an electrical cut-out, thus affording protection to the mechanism. The lamps can be placed upon circuits of any current (from five to eight amperes) without change of adjustment. The arc voltage remains constant under all conditions. At 6.6 amperes and 72 volts at the arc, the total apparent watts at the terminal is 475. Total true watts, 430. The true watts at the arc are 425, showing the loss to be five

watts in the mechanism and the efficiency of the lamp to be .99. The power factor of the lamp is .91.

In connection with these lamps, the San Gabriel Company will use nine Manhattan regulating reactance coils of 25 per cent. capacity; in other words, each coil will take care of the extinguishing of 25 per cent. of the circuit. The regulator consists of a single automatic action regulating reactance coil in series with the lamps. A single coil is swung at one end of a lever arm, so that by moving vertically it will enclose more or less of one leg of an upright "U" core, the other leg acting to complete the magnetic circuit. At the opposite end of the lever arm is a weight which overbalances the weight of the coil, so that normally the coil is held outside of and above the core. When the circuit is completed to start the lamps, magnetic attraction causes the coil to be drawn down over the core. The action of the weight holds the coil in equilibrium when the desired current is flowing through the circuit. When lamps are switched off and the current tends to rise, the coil is drawn to further enclose the iron, the reactance effect increases, and the current is thus held constant. This regulation is absolute to within one-tenth of an ampere, on any size regulator or at any load.

The loss in the regulator is constant, either at full or minimum load, being simply the $C^2 R$ in the coil, plus a very slight iron loss. The regulation is perfect to within one-tenth of an ampere from maximum to minimum load (latter may be zero if desired). This regulator may be furnished to provide for the extinguishment of the whole or any part of the circuit, as may be desired.

The capacity of the regulator, the insulation, etc., need only be in proportion to the number of lamps to be extinguished. This gives a very simple and compact device. It will thus be seen that, where the Manhattan regulator is to take care of but 10 per cent. of the load of the circuit, it requires an insulation against only 10 per cent. of the e. m. f. of the circuit, so that a large number of lamps, with very high voltage, can be handled with safety. There are no complicated parts—simply a core, a single coil, an arm with one support and a counter-weight, and there is no chance of decrease in the delicacy of regulation through wear or accumulation of dirt. The loss of these coils is but 200 watts at any load, and as there will be nine coils employed in this installation, the loss in the regulators will be only 1800 watts. To this must be added 20 watts per lamp in 850, showing very economical operation.

The power factor of the circuit, including lamps and regulators, is .89 to .90. The lamps will run 100 in series on a 7500 volt primary circuit.

Telephone System at Richmond, Ind.

The American Electric Telephone Company, of Chicago, U. S. A., have just completed an important switchboard installation for the Richmond Home Telephone Company, Richmond, Ind. The switchboard is arranged for magneto call, that is to say, the subscriber's station equipment includes a magneto generator, which, when driven, sends an alternating current over the line wire and by passing through the annunciator magnet placed upon the switchboard, tends to throw a shutter which apprises the operator of the subscriber's call for attention. The switchboard, which is arranged with an immediate drop capacity for 1000 lines, may be increased to a total ultimate capacity for 2000 lines. The method employed for interconnecting a caller's line jack with that of the called-for subscriber's line jack, is based on the principle of transferring or extending the caller's connection from the receiving operator's position to that operator's position on whose board the called-for subscriber's line jack terminates. That is to say, supposing No. 300 subscriber calls in, the "C" operator noting the signal, plugs into the line jack which is located immediately below the fallen shutter, and inquires as to the caller's needs, which we will say, for example, is a request for connection with subscriber No. 750. Obviously, the line jack No. 750 is not within reach of the "C" operator; therefore it will become necessary to extend the No. 300 subscriber's line jack connection to the No. 7, or "H" operator. This is done as follows:

Each operator's position of the entire switchboard installation is equipped with trunking jacks, two for each operator's position in the entire equipment. In view of the fact, however, that the operators' positions immediately to the right and left of a given board can be reached direct, it is only necessary to supply the "C" operator with 14 trunking jacks. These trunking jacks (taking the "C" and "H" boards for the sake of our description) each terminate in a cord with plug.

Thus, the "H" operator has two transfer cords coming from the "C" operator and the "C" operator has two transfer cords connecting to trunking jacks on the "H" operator's position, this being true with all the remaining positions as described above. Now, then, subscriber No. 300 has been responded to by the "C" operator, who, we will say, for example, placed the answering plug of an unused pair of inter-connecting cords into the line jack No. 300. Picking up the calling plug and knowing that subscriber No. 750 is on the "H" board, the calling plug is placed into one of the unused trunking jacks which terminates in a cord and plug on the "H" board. This act lights a lamp setting immediately above the transferring plug on the "H" board. Then the "C" operator manipulates an order key, which connects her operator's set together with that belonging to the "H" operator—and instructs her to place the transfer plug into the subscriber's line jack No. 750.

Upon the receipt of the order, the "H" operator picks up the proper transfer plug and on removing it from its socket extinguishes the lamp; then she places the transferring plug into the line No. 750, and by pressing the plug inward against the tension of a spring, momentarily connects the calling generator to the subscriber's line jack springs—this to the exclusion of the waiting subscriber's circuit. After the inter-connected subscribers have completed their conversation, the line drop on the "C" operator's board by falling records their desire for a dissolution of the inter-connection. The "C" operator then listens in and finding that the line is clear removes her answering plug from the line jack No. 300, and also the calling plug from the trunking jack above referred to.

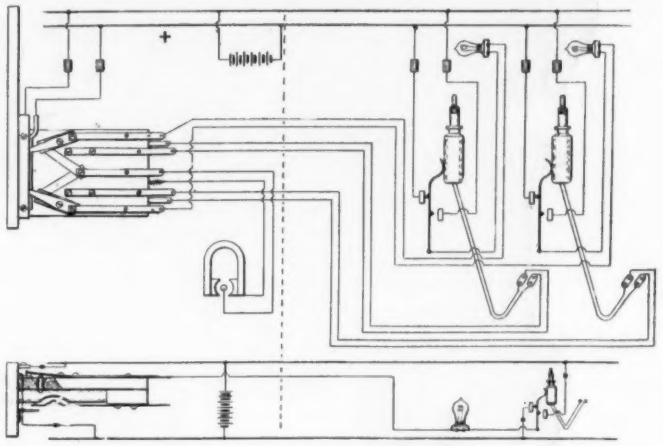


DIAGRAM OF CONNECTIONS.

The act of removing the calling plug from the trunking jack results in establishing a connection which may easily be followed by referring to the accompanying illustration; this connection resulting in again lighting the lamp placed above the transferring plug on the "H" operator's position. The "H" operator on perceiving the lighted lamp observes that it belongs to the plug inserted into the subscriber's line jack No. 750, and understands by this signal—without any further orders from the "C" operator—that that particular transferring plug needs to be restored to its seat, which, if done, again extinguishes the lamp.

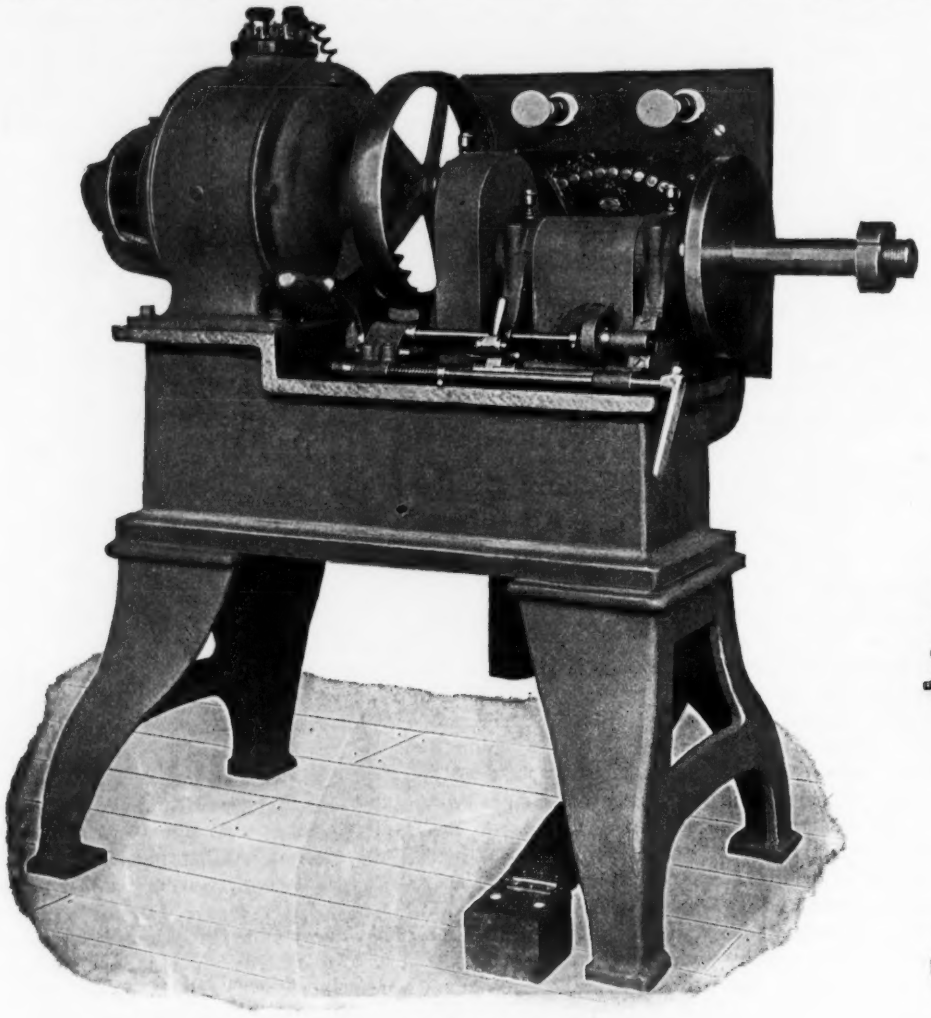
Prior to the introduction of the above transfer system, it had been universally conceded that a trunking system could not well be operated in exchanges giving service to more than six or eight hundred subscribers. Not only has this method succeeded as a successful trunking system for exchanges up to 4000 and 5000 line capacities, but it has actually installed and is now operating an exchange system using the above method of trunking for 3500 subscribers averaging a total of 32,000 calls per day. Not only is the system an operative one, but it is giving a service second to multiple boards only in requiring two operators in completing a connection with the transfer system, whereas, as it is well known, the multiple system requires but one operator.

THE PACIFIC CABLE.—It is understood that President McKinley has his mind firmly made up on the necessity of an American Pacific cable, and that it will be one of the things for which he will ask the earliest attention and action of Congress as soon as it meets.

Power Electric Motors.

The Western Electric Company has designed a type of encased motor for special application to power purposes, one of which is shown in the accompanying illustration direct connected to a special piece of machinery. This type of motor, as will be seen, is completely encased. The commutator end is supplied with removable covers which, when taken off, render the commutator and brush holder very easy of access. These covers are supplied with mica windows so that the brushes and commutators can be seen.

The field magnets and magnet cores are made of steel. The magnet cores are bolted in place and permit the use of field coils of circular form, which shape is most conducive to economy. The iron teeth of the armature are so proportioned that the loss in eddy currents in the pole pieces is negligible, and the pole tips are extended so as to cover a considerable portion of the armature surface, thereby reducing the magnetic reluctance and consequently the expenditure of energy for excitation. The bearings are self-oiling and self-aligning. The brush holders are light and firm, and so designed that the vibration of the machine from outside causes or the reversal in rotation of the armature, in no way intereferes with the operation of the machine. The motors are noiseless in operation and are so designed that the brushes can be fixed in a set position and the load varied anywhere from no load to full load without necessitating any movement to counteract sparking.



SPECIAL APPLICATION OF POWER MOTOR.

Centrifugal Exhaust Head.

The design of this exhaust head, illustrated herewith, simple as it is, reveals a clear understanding of the principle involved in the successful separation of water and steam. As is well known, centrifugal force is proportional to the weights of the bodies in motion. Therefore, a cubic foot of water, revolving around a centre, will exert 1562 times the force exerted by a cubic foot of steam, for water weighs 1562 times as much as exhaust steam of the same temperature.

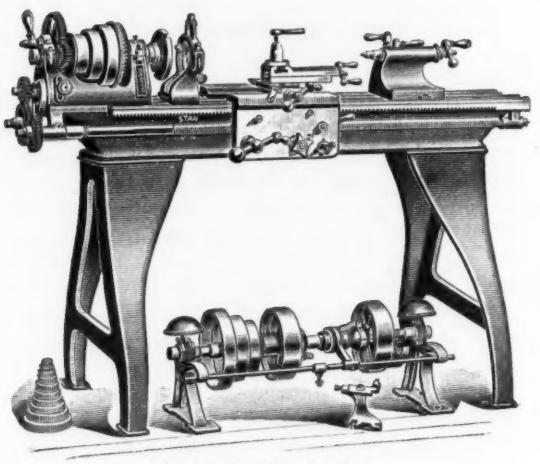
Therefore, if a mixture of water and steam be given a whirling motion within a circular case, the water will be thrown violently against the sides, and absolutely separated from the steam. The dry steam will readily escape upward through a central opening which the water cannot reach, owing to the opposition of centrifugal force. Upon this principle the Sturtevant exhaust head shown is designed. It is thus absolute in action, and produces no back pressure upon the engine.

It is built of heavy galvanized iron, 16 to 20 gauge, according to size, all external joints are close riveted and soldered, and the internal pipes are double braced. The B. F. Sturtevant Company, Boston, Mass., builds these heads in sizes to fit pipes from 1 in. to 20 in., and flanged in sizes above 10 in.

STURTEVANT CENTRIFUGAL EXHAUST HEAD.

Screw Cutting Lathes.

We illustrate herewith a new pattern of screw cutting lathe, especially designed for electrical and other fine machine shop service. This lathe has also been found particularly adapted for technical school shop service. The end thrust of the lathe, which will cut U. S. standard, Whitworth or metric threads, is taken up by ball-bearings, and the bearings are all of phosphor bronze. The tail stock is of such a shape as to allow the compound rest to swing around parallel to the ways with room to operate a feed screw handle.



SCREW CUTTING LATHE.

The tail stock has a steel spindle arranged with a self-discharging centre, and also a locking device which insures perfect alignment. It is provided in addition with an adjustable side movement for turning tapers. The carriage has a cam-locking device for securing it to the bed when the cross feed is in use. The automatic cross and longitudinal feeds are actuated by a phosphor bronze worm on the lead screw, which latter for all work except screw cutting simply acts as a feed rod, thus reducing wear. The feed may be thrown in or out of contact by simply turning a hand knob in the apron.

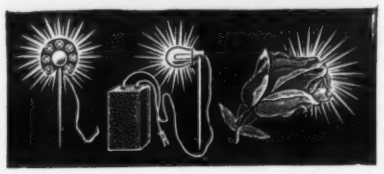
The lead screw is of steel and provided with an open-and-shut

nut. The lathe will feed in or out, right or left, cut right or left handed screws and may be thrown out of gear entirely by moving a lever in the head stock, without changing the motion of the driving power.

The lathe described, known as the "Star" lathe, is made by the Seneca Falls Manufacturing Company, Seneca Falls, N. Y.

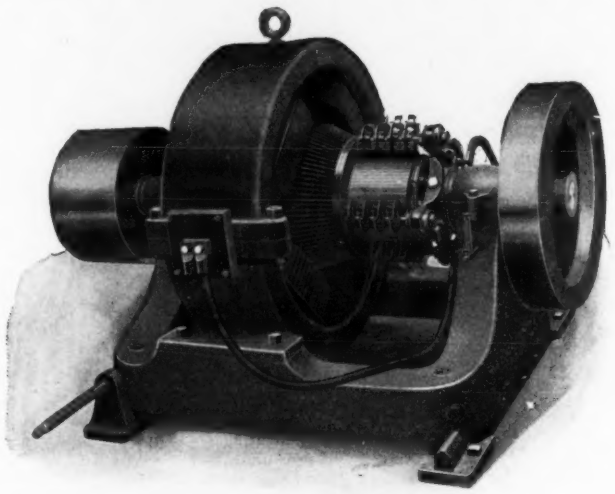
A New Combination Scarf Pin.

William Roche, 42 Vesey Street, New York, the inventor and sole manufacturer of the well known "New Standard" dry battery, is placing on the market a new combination electric scarfpin. The small incandescent lamp, regularly made and carefully exhausted, is separable from the scarfpin. It can thus be used with the scarfpin or without, and can also be hidden away in the center of a natural rose or any flower, throwing its rays through the delicate petals or leaves of the flower and producing a very pretty illumination with artistic effect. It is operated by three small cells placed in a neat leather case conveniently carried in a man's pocket or the folds of a lady's costume. This ingenious trade novelty is mailed to any address, postage prepaid.



Bernard Gas Engine Generator.

A modification of the standard Bernard multipolar generator, shown in the accompanying cut, is especially constructed for gas engine isolated electric lighting plants. As will be seen, the generator, in addition to the belt pulley, is equipped with a heavy rim (web pattern) fly-wheel, so as to automatically provide for uniform rotation under the considerable variations of driving effort which occur in a gas engine cycle. As in the standard type of the same engine, ample provision is made for armature ventilation, and the commutator surface is unusually generous. The carbon brush holder is of a special design which enables the brush pressure to be nicely adjusted and automatically maintained. The apparatus is built by the E. G. Bernard Company, Troy, N. Y.



GAS ENGINE GENERATOR.

Addition to the Holtzer-Cabot Electric Company's Factory.

About two years ago the already large works of the Holtzer-Cabot Company, Brookline, Mass., were extended by the erection of two additional buildings, which at that time were considered ample to accommodate their business for many years to come. So great, however, has been the demand for this company's different specialties that they have been again compelled to build another large addition to their factory, that they might be able to more promptly fill the numerous orders which they are receiving in all departments. The new building which adjoins the old contains four stories which will be devoted chiefly to the telephone and dynamo and motor departments.

There are few houses in the electrical field which have enjoyed so steady an advancement as the Holtzer-Cabot Electric Company, started by Mr. Holtzer in the early 70's. The company has always been in the foreground of electrical progress, and while taking advantage of every development of electrical research has also made it the prime factor of their business that their products should be constructed in the best mechanical manner. With a policy such as this it is small wonder that the history of the concern should be one of continual advancement. It is impossible here to enumerate all the different electrical appliances that this company are turning out. In their motor and dynamo department the machines range from small motors to large multipolars capable of developing 60-hp. Every detail is carefully considered so that when completed they are not only handsome in appearance but substantial and perfect in each component part.

Generators for telephone work are one of the specialties for which this company has a most enviable reputation. Some of these machines which are intended to operate on the transmitter circuit of a telephone exchange are so designed and constructed that no perceptible noise due to commutation is audible even when a delicate receiver is placed directly in the circuit. Another large department is that devoted to the manufacture of magneto bells, for which they have a capacity that allows of their turning out over 200 of these instruments per day.

Some other products of this enterprising manufacturing company are electric gas lighting supplies, watchman's clocks, intercommunicating telephones and various other specialties. Of course, a great many people are required to turn out the large variety of work in the differenet departments of the company, and as all goods are constructed from the raw material it necessitates the centralizing of experts in nearly all trades known to the arts. Besides the staff of electrical and mechanical engineers and draughtsmen there are cabinet makers, machinists, platers, decorators, etc. Many of the machines employed in constructing the various parts of the different apparatus manufactured are specially designed for the work, and are built on the premises. From the fact that the head of the house is a thoroughly practical man, a great many labor-saving devices have been introduced, which allows of work being performed by machinery that is usually done by hand.

Having been so long in the electrical business and having always devoted such care in the construction of every piece of apparatus that leaves the factory, it is needless to say that the company's goods are widely and favorably known, and their orders are received not only from all parts of America, but in growing numbers from nearly every part of the globe.

American Institute of Electrical Engineers.

The first regular meeting of the season was held at 12 West Thirty-first Street, New York City, Wednesday, Sept. 27, President Kenelly in the chair. The paper of the evening, presented by Prof. W. Lispenard Robb, of Hartford, Conn., was on "Series Arc Light-From Alternating Current Transformers," and a working model of the apparatus was shown which was heartily appreciated by the audience. The discussion was participated in by Messrs. Fleming, Steinmetz, Hallberg and Mailloux. At the meeting of the Council in the afternoon the following associate members were elected: Campbell Henry Arthur, Electrician Jamaica Electric Light & Power Co., Ltd., 38 Harbor Street, Kingston, Jamaica; Davis, Leslie Foster, secretary and manager Jamaica Electric Electric Light & Power Co., Ltd., 38 Harbor Street, Kingston, Jamaica.

The following associate members were transferred to membership: William Enoch Moore, general superintendent and electrician, the Augusta Railway & Electric Co., Augusta, Ga.; Henry M. Hobart, engineer, care British Thomson-Houston Co., London, England; G. Sacco Albanese, electrical engineer, Tramways Electrique de Nice, Nice, France.

In order to satisfy the increasing demand for the final report of the Committee on Standardization, the Secretary was authorized to publish a special edition which will be sold at a nominal price. All members of the Institute have already been supplied with copies in the regular edition of the Transactions.

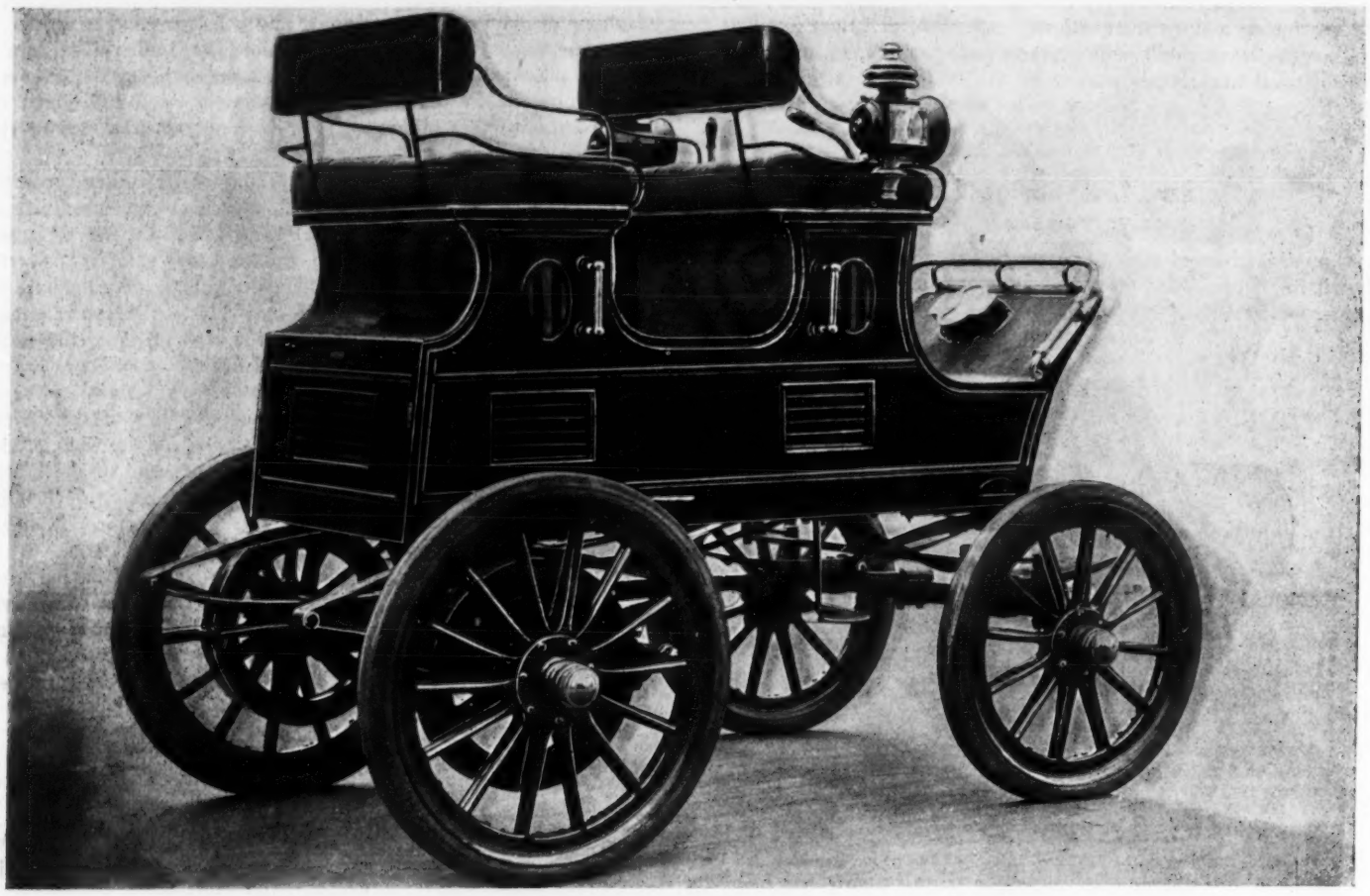
Large Electric Break.

The automobile "break," illustrated in the accompanying cut, has a capacity for five passengers, two on the forward and three on the rear seat. The accumulator equipment consists of 44 cells of 120 ampere hours capacity, and weighs 700 pounds. On a level road at a medium speed, the carriage can travel 50 miles on a single charge. One of the features of the vehicle is the form of tire employed, which is of the flat-tread type, consisting of a 3-inch rubber tube nearly square in cross section, with a ¾-inch rubber facing.

The rear wheels are 36 inches in diameter and the front wheels 32 inches, steering being accomplished by turning the latter. The motor, of the four-pole type, which is on the rear axle, is rated at 3-kw, but can develop about twice that power for a short period. The armature shaft of the motor is hollow, and one end of it terminates in a cylinder holding a single-reduction differential gearing, which runs in vaseline. From this cylinder two steel shafts—one passing through the hollow armature shaft—run out to the rear wheels and are provided with pinions which mesh on large gears keyed on the hub. The differential gear takes care of the curves, putting the motive power on the outside wheel on all turns, this being necessary from the fact that only one motor is used on the vehicle. The cylinder enclosing the gear is used as a drum for an auxiliary brake, it being clasped by two small friction clutches when the brake lever is thrown, which release automatically when the pressure of the operator's foot is removed. The main brake is applied to a flange on the counter gear. All of the journals are fitted with ball bearings.

The controlling circuits are such that five speeds may be obtained, the maximum being 14 miles per hour under favorable conditions, and the others 3½, 5, 8 and 12 miles per hour. For the smaller speed the controller puts the two halves of the battery in parallel and a resistance in the armature circuit. For the next speed the resistance is cut out. The third motion of the controller puts a portion of the resistance in shunt across the field terminals, the battery remaining as before. The fourth step puts all the cells in series and cuts out the shunt, which is again inserted for the highest speed. The break is made by the American Electric Vehicle Company, of Chicago.

Other incidental but important features in this vehicle are the good contacts, simplicity of testing, ease of re-fusing and low cost of maintenance.



ELECTRIC BREAK.

Fuse Terminals.

An important element in electrical construction for interiors, etc., are the fuse terminals, and these have been made a specialty by the Moon Manufacturing Company, of Chicago. Their product, designed for telephone and telegraph cables, etc., is intended to give absolute protection from lightning, trolley current, electric light circuits and high potential current in general, and serves also as a seal against the moisture that is so often detrimental to paper cables.

In the lightning arrester form each terminal connection where it enters the metal box or head, is first brought near, but not in contact with a large copper ground conductor; also the head being a heavy mass of metal with ground connection, and with the further obstruction offered by our long fuse between the cable end, which is in the box, and the pole wires, makes it a most perfect protector to cables.

The plain terminals are intended for use where there is no chance of lightning, or other high potential currents getting on the distributing wires, such as office buildings, where the head is placed in basement and the wires distributed through the building, or in places where it would be preferable to use separate fuse board. These heads are made of the same material and precaution as the fuse terminal, and they make a perfect seal and distributer for the cable.

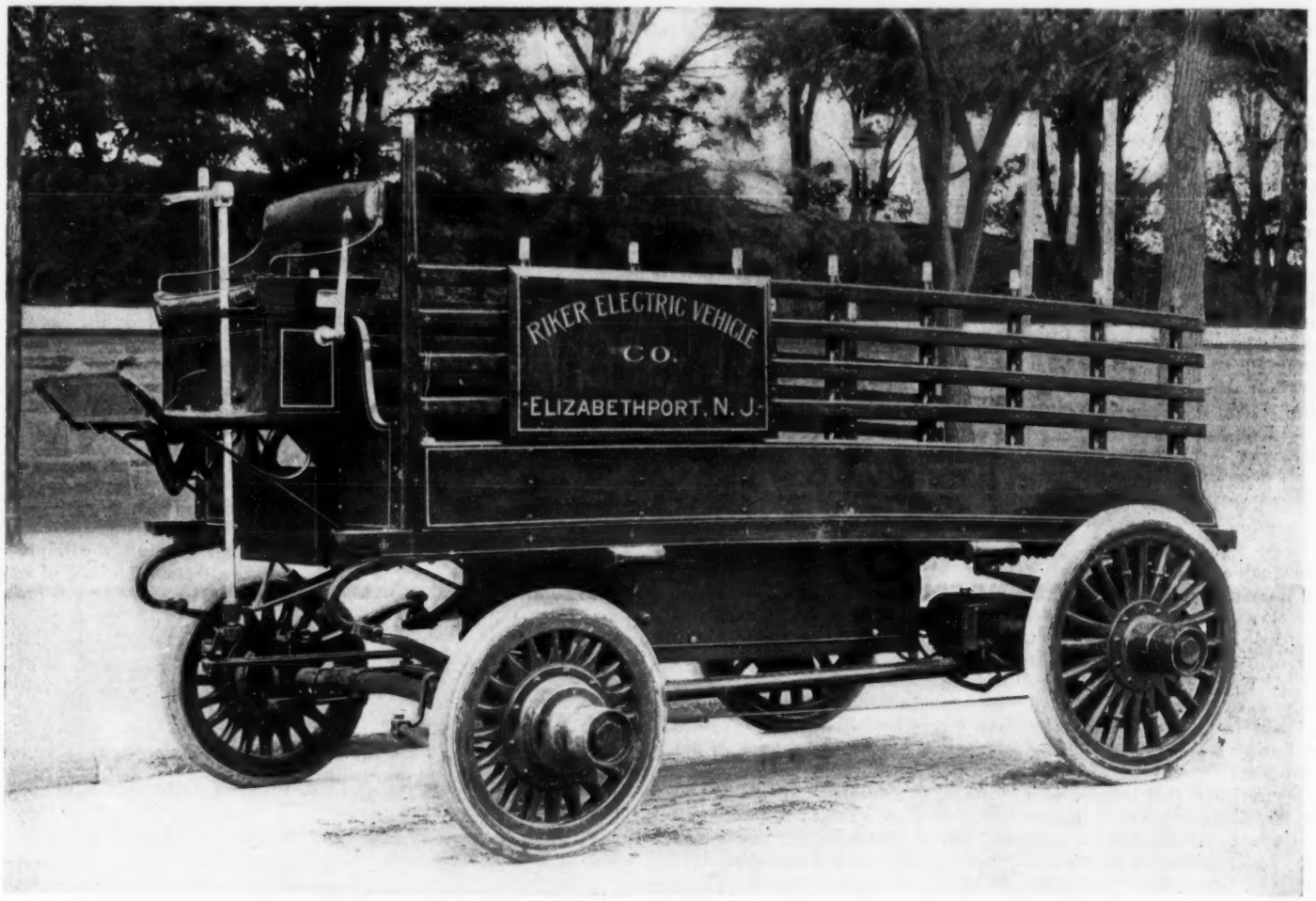
The Moon terminal casing is made of the very best galvanized iron with an extra heavy coating of mineral paint, thus making it rust proof, and with sliding cover instead of hinges, thus rendering it dust proof; without any cracks or crevices, making it storm proof; well stayed and riveted, very strong and durable, and never affected by the weather.

The sliding doors permit the workman to operate easily in the testing and transposing of lines, hence a great saving of time to the company.

The Riker Electric Truck.

The first electric truck or dray to be built in this country, so far as we are aware, is that which is illustrated on this page. It has been designed and fitted up by Mr. A. L. Riker for the Riker Electric Vehicle Company, of Elizabethport, N. J. The carrying capacity of the truck is no less than six tons and a speed can be maintained of 2, 3 or 6 miles per hour. The batteries weigh 3000 pounds and are capable on each charge of a run of 20 miles on heaviest work. The truck itself, with motors, weighs 7000 pounds, making a total weight for the vehicle of 10,000 pounds. There are two motors of 10-hp each, and each is geared to one of the wheels on the rear axle. The truck is equipped with the Riker flexible running gear. The wheels have 4 inch solid rubber tires. The front wheels are 38 inches in diameter and the rear wheels are 44 inches.

The Riker Electric Vehicle Company have recently shipped a number of orders abroad, including the demi-coach for Paris, already illustrated in these pages, and a variety of other types. Their new factory is now equipped for an output of five vehicles a day complete.



Electric Truck.

New Chemical Compound.

The Federal Battery Company, 11 Pine Street, New York City, are placing on the market a new chemical compound, which is claimed to give their battery many advantages. A number of tests and reports have been shown to us on the subject. The salt can be used on any open circuit work, and is said to increase the potential e. m. f. of the carbon-zinc cells very materially, giving an initial voltage of from 1.7 to 1.9 volts. Some of these batteries were placed on special trial about February 1, 1899, and, therefore, have had about 7 months' service. They have required no attention except to be filled up with water. Compared with new Leclanche porous cups none of the cells showed as high as at first, but at the end of five minutes they all showed up better than the porous cups that had been used on the set for a month, and in which the solution has not yet crystallized, showing that the porous cups have not had very hard service. The internal resistance is approximately the same as the Leclanche. The tests were made by leaving the telephone off the hook for five minutes, except for the instant the readings were taken. The solution does not seem to crystallize as sal ammoniac does, but, instead, on the hard worked stations, forms a perfectly white sediment at the bottom of the jar about the consistency of partially dissolved soft soap, and it feels something like it. This sediment has settled on the carbons, but seems to wash off easily and the penciled zincs are about half used up. Among those interested in the battery are Mr. A. M. Young (who was formerly a telegraph official before going into electric light and railway work) and Mr. Walton Ferguson. Mr. F. C. Overbury is the general manager of the company.

New Anti-Friction Device for Automobiles.

Mr. J. Brewer, a civil engineer, of London, England, is now in this country to introduce a new form of anti-friction device for automobiles. Applied to a truck carrying 5 tons and previously hauled by two horses, it was found that one horse could haul it comfortably. The device can be applied easily to any automobile. Mr. Brewer has with him a half ton working model of the device.

Columbia Incandescent Lamp Co.

During the month of September the Columbia Incandescent Lamp Company, of St. Louis, found business extremely active and heavy. Notwithstanding the fact that they had worked their factory overtime, they have remained considerably behind orders. They expect to increase their output about 25 per cent. within the next week or ten days, and this will enable them to catch up and resume prompt shipments before the middle of October. They have lately closed some very large and satisfactory contracts for street railway lamps, among them being one for the Third Avenue Railroad in New York City, beginning at once.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET was necessarily a short and broken one, for after all that is said to the contrary by those who know nothing about it, there the spirit and sentiment of patriotism are intense and strong. Friday and Saturday being Dewey holidays, there were actually but four business days. On the whole, the short week represented much the same conditions as its predecessor, and stocks were low, although there was a rally at the close. Rates for money continued very high, and as a general thing it may be said that a feeling of nervousness was caused by the near possibility of trouble in the Transvaal. In fact, the decline due to the state of affairs in Africa was more marked here than in England, where they learned long ago to take great successes quietly and big disasters with stolid equanimity. During the week 1970 shares of Western Union were sold, closing at 88, a gain of ¼. On 900 shares only, General Electric declined 2 to 120. On 317,900 shares, Brooklyn Rapid Transit was up to 91, a gain of 1⅝; and on dealings in 21,400 shares, Metropolitan Street Railway declined 4 to 196½, the dividend coming off. In Boston the telephone stocks were fairly steady and strong, American Bell closing at 361. In Philadelphia, Electric Storage Battery closed at 125-127 common, 128-130 preferred; Penn. Mfg. 28¼; National Electric, 10⅝; Union Traction, 38¾; Phila. Traction, 96. Electric Company of America, 17¾; Penn. Electric Vehicle, 12 common, 5 preferred; Consolidated Traction of New Jersey, 66. In Chicago, Union Traction sold at 82½; West Chicago Railroad, 120; Metropolitan Elev., preferred 68⅜; South Side Elev., 99½. In the New York outside market, Electric Axle Light sold at 5⅜-5¾; Electric Vehicle, 86-90 common and 105-115 preferred; Electric Boat, 20-23 common and 40-45 preferred; New York Electric Vehicle Transportation, 18½-20; New England Electric Vehicle Transportation, 8¾-9¼; Illinois Electric Vehicle Transportation, 4-5; and no great movement was noteworthy in any of the others.

ROYAL ELECTRIC COMPANY.—The shareholders of the Royal Electric Company, of Montreal, have authorized the directors of the company to increase its capital stock to double its present amount. The present capital is $1,500,000, so the increase will make it $3,000,000. For the time being, however, only $750,000 new stock will be issued, this being decided upon by the directors at a later meeting. The increase will be at the rate of one share in two at par, and the stock will be issued to the shareholders of record of Sept. 30. The calls will be made in four instalments, the first of 25 per cent. on Oct. 15, and the remaining three on the 15th of November, December and January following. The shareholders are given the option of paying in full on the 15th of October, and in that case the stock will bear the full dividend. It is not known when the remaining $750,000 will be issued, and it is not likely that it will be decided upon for some months. The announcement of this large increase in the capital stock of the Royal Electric Company came as something of a surprise to the "street," as it was expected that an increase of only $750,000 would be asked for. As it is the directors have decided to issued that amount of stock, and have the power to issue the remainder at any time they may deem expedient.

NORTHWESTERN ELEVATED.—Chicago despatches regarding alleged offers by Whitney and others, of $13,000,000 cash for the purchase of the Northwestern Elevated Railroad, are declared by competent authority to be only partially correct. Last summer overtures were made to Blair & Company, who, when the road was still unfinished, loaned the company $5,000,000 to complete it. When ready for business it will have cost $15,000,000. Blair & Company say that when the overtures were made last summer, the talk was around $13,000,000. To-day the road could not be built for $15,000,000, as cost of material, labor, etc. has all advanced. It is, therefore, easily understood why an offer of $13,000,000 would not be entertained. When completed the road will be bonded for $5,000,000 first mortgage 5 per cent. bonds, $5,000,000 preferred stock, and $5,000,000 common stock, which will be less than the actual cost of the road. The construction is the strongest of any elevated road ever built, and the electrical equipment perfect.

CHICAGO UNION TRACTION.—Some preferred stockholders of the Union Traction Company, of Chicago, are felicitating themselves on much prospective good fortune. The certificates of the new company are now ready for delivery by the engravers, coincident with which is the report that the preferred shareholders are to fare very much better than was originally disclosed. The company is capitalized for $12,000,000 preferred and $20,000,000 common. Subscribers to the preferred were to receive a 50 per cent. bonus in common stock, this distribution taking $6,000,000 of the $20,000,000 common, the remaining $14,000,000 to remain in the treasury as an asset subject to further official disposition. But now it is stated that the entire $20,000,000 is to be distributed, the $14,000,000 as well as the original bonus of $6,000,000 going directly to the preferred stockholders, whose claim to it is based on the fact that they are the only contributors of actual money to the enterprise.

HARRISBURG TRACTION.—The directors of the Harrisburg (Pa.) Traction Company have declared an extra dividend of 1 per cent., payable on the 1st of October. It has been decided for the present to pay an extra annual dividend of 5 per cent.—1½ per cent. in January and July and 1 per cent. in April and September. The Traction Company is doing the largest business in its history and the future outlook is exceptionally bright. No stock can be had under $60 a share and the figure does not tempt holders. Mr. E. Bailey, President of the Harrisburg National Bank, becomes president.

CENTRAL & SOUTH AMERICAN TELEGRAPH COMPANY.—Accompanying the notice of quarterly dividend of 1½ per cent. on the stock of the Central & South American Telegraph Company, is the treasurer's statement for three months to Sept. 30, showing an estimated addition to surplus of $6697 for the quarter; notwithstanding the interruption of all lines south of Iquique, connecting with Chili and Argentina, for twelve days during August, by an unusual storm. The total surplus after dividend is $502,166, an increase of $113,760.

CHICAGO METROPOLITAN.—It is reported the average showing of Chicago Metropolitan Electric Railway since February last has been equal to 4 per cent. on the preferred stock. During the latter part of the last month the average daily traffic has been in excess of 80,000 passengers. The gain for the entire month will probably exceed September, 1898, by 25 per cent. Cost of operation is said to be under 45 per cent. of the gross.

BOSTON EDISON ILLUMINATING.—The Edison Electric Illuminating Company at its special meeting, by a vote of 25,637 shares, voted to ratify the action taken by the company's executive committee authorizing the vice-president to petition the board of gas and electric light commissioners to issue such amount of additional capital stock as would net $750,000. The meeting adjourned until Oct. 10, the day of the annual meeting.

SALE OF FORT WAYNE ROADS.—The Fort Wayne Consolidated Street Railway and all park lines have been sold to C. A. Garretson, representing Cleveland stockholders, for $1,092,000, at a receiver's sale. The purchaser represents the Reorganization Committee. The Robinsons, of Cleveland, own much of the common stock, but it is doubtful if they will ever regain control.

WESTINGHOUSE STOCK.—The New York Stock Exchange has approved the listing of $487,500 assenting stock additional of the Westinghouse Company, and the company's application stated that the net earnings for the four months ending July 31, 1899, were $558,431.

PHILADELPHIA.—The Pennsylvania Manufacturing Company will pay a semi-annual dividend of 50 cents a share, October 15, aside from its arrangement with the National Electric Company.

MEXICAN TELEGRAPH.—The directors of the Mexican Telegraph Company have declared the regular quarterly dividend of 2½ per cent., payable Oct. 14.

THE NEW YORK & NEW JERSEY TELEPHONE COMPANY has declared a dividend of 1½ per cent., payable Oct. 14.

METROPOLITAN STREET RAILWAY COMPANY, of New York City, has declared a dividend of 1¾ per cent. on the capital stock of the company, payable Oct. 16, to stockholders of record Sept. 28.

OTIS ELEVATOR.—The directors of Otis Elevator Company have declared the regular quarterly dividend of 1½ per cent. on the preferred stock, payable Oct. 15.

EASTERN CONSOLIDATED.—It is authoritatively stated in Philadelphia that Eastern Consolidated Electric will in November declare a first semi-annual dividend on the stock.

METROPOLITAN STREET RAILWAY COMPANY, of New York, shows an increase of $208,521 in September gross earnings, as compared with the same month last year.

ENGINEERING SOCIETY LIBRARY, UNIVERSITY OF MICHIGAN

Commercial Intelligence.

THE STATE OF TRADE.—While last week was a broken one in New York it brought to town a great many people who combined business with pleasure very shrewdly, and the result was if anything greater activity than ever. For the country generally reports are excellent, and the demand for agricultural products is one of the strong features of the situation. Railroad earnings continue to make very favorable comparisons with a year ago, the gross receipts of fifty-two systems for the third week of September aggregating $7,959,688, an increase of 10.3 per cent. over last year, when, it will be remembered, gains were very large. Business failures for the week, five days, number 129, as compared with 147 last week, 166 in this week a year ago, 189 in 1897, 325 in 1896 and 245 in 1895. In the metal market, pig iron remained very strong and steel billets were quoted in Pittsburgh at $39 per ton, the price a year ago being $16. Copper, as we anticipated, is already a shade lower, and was quoted last week at 18⅜ cents for Lake, although even at that price customers apparently did not want any of it for the present. There are so many reports as to possibly cheaper copper, due to new production, people begin to believe them. But as the price falls, the demand will rise, so that a sharp decline can hardly be expected.

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following exports of electrical material were made from the port of New York, for the week ending Sept. 29: Argentine Republic—9 packages electrical machines, $54; 36 packages electrical machines, $2,117. Antwerp—31 packages electrical material, $3,388. British West Indies—6 packages electrical material, $116. Brazil—60 packages electrical material, $2,510. Berlin—27 packages electrical machinery, $5,100. Cuba—26 packages electrical material, $667. Hamburg—2 packages electrical material, $20. London—9 cases electrical carriage, $960; 3 packages electrical material, $125. Leeds—30 cases electrical material, $625. Mexico—21 cases electrical material, $798; electrical material, $218. Manchester—1 case electrical material, $54. Peru—20 packages electrical material, $739. Porto Rico—2 cases electrical material, $101. Rotterdam—1 package electrical material, $50. St. Petersburg—206 packages electrical material, $5,425. Southampton—24 packages electrical material, $655; 18 packages electrical material, $2,036. Sandwich Islands—50 cases electrical material, $3,169. U. S. Colombia—14 packages electrical material, $756. Uruguay—1 package electrical material, $25.

RAILROAD CONTRACT IN OHIO.—Further information has been given out regarding the extensive contract recently awarded to Westinghouse, Church, Kerr & Company, for equipping an electric railroad between Toledo, Fremont and Norwalk, Ohio. The line will be over sixty miles in length, running through Woodville, Fremont, Clyde, Bellevue and Monroeville. When this road was first promoted, Westinghouse, Church, Kerr & Company were appointed the engineers and architects and they are designing the system throughout, including the electrical equipment, the central power station, the sub-stations for feeding the lines, the overhead construction, car shops, car barns and the general equipment of the road. Recently the contract for the execution of these plans has been awarded to the firm. The most advanced ideas of electrical construction will be embodied in this road. Three-phase alternating current will be employed, instead of direct current, which is usual in suburban traction; this system will enable the whole line to be supplied from one central power station. At Fremont the power station will be erected and the current transmitted at a high voltage in both directions. The power station will be furnished with five 300-hp Babcock & Wilcox boilers, equipped with Roney mechanical stokers and coal and ash handling machinery. Two 4000-hp Worthington central elevated jet condensers will be provided, also hot feed water and a good draft will be provided by a Westinghouse mechanical draft and economizer system while the feed water will be treated before being pumped into the boilers to remove the scale forming properties. The exhaust steam from the auxiliary engines will be used for heating the feed water on its way to the economizer, an economizer being applied to heat the feed water up to a very much higher temperature than is possible with exhaust steam feed water heaters. Four Westinghouse Columbian type engines will be directly connected to four 500-kw Westinghouse engine type three-phase generators; each engine with its generator being mounted upon a massive bedplate, insuring accuracy and permanency of alignment. Two 9 and 15x9 Westinghouse single acting compound engines will be directly connected to two 30-kw exciter generators. In addition to the Fremont central power station, six sub-stations will be built about equi-distant from each other along the line of the railroad while a seventh sub-station will be provided within the power house at Fremont. The current generated at the central power station will be raised by Westinghouse transformers and transmitted at a high voltage, about 15,000 volts, to the sub-stations, and there lowered by appropriate step-down transformers and changed by Westinghouse rotary converters from alternating to direct current for feeding the trolley lines. Each sub-station will be equipped with three stepdown transformers and two rotary converters, together with a switchboard and controlling apparatus, and will be connected by feeders with the trolley line and direct current feeders. The roadbed will be very substantially constructed, as it is intended to run the cars at a speed upward of 40 miles an hour. By adopting the alternating current it is possible to supply the entire sixty miles of the Toledo, Fremont & Norwalk Electric R. R. from one central power station, and to reach out to supply feeders in all directions or extend from the terminii. The saving in copper wire alone by using a high tension transmission is estimated at considerably more than $100,000.

WOODS MOTOR VEHICLE COMPANY.—The Woods Motor Vehicle Company has been incorporated under the laws of New Jersey, with a capital of $10,000,000, to manufacture automobiles. The directorate comprises John W. Mackay, President of the Commercial Cable Company; August Belmont, banker; Dr. W. Seward Webb, President of the Wagner Palace Car Company; Charles Miller, Standard Oil Company; the Hon. George A. Cox, President of the Canadian Bank of Commerce; J. Wesley Allison, United States representative of the Canadian Government railway system and Wagner Palace Car Company; W. D. Matthews, Director of the Canadian Pacific Railway; H. P. Dwight, President of the Great Northwestern Telegraph Company; A. E. Ames, Vice-President of the Imperial Life Insurance Company; J. W. Lavelle, President of the National Trust Company, Toronto; Frederic Nicholls, President of the Canadian Northern Railway and Vice-President of the Canadian General Electric Company; H. A. Ware, Vice-President of the Northerwestern National Bank; C. E. Woods, General Manager of the Woods Motor Vehicle Company; Benjamin V. Becker of Newman, Northrop, Levinson & Becker, and Sir William C. Van Horne, Chairman of the Board of Directors of the Canadian Pacific Railway system. Frederic Nicholls is president of the new corporation; J. Wesley Allison and A. E. Ames, vice-presidents; A. E. Chandler, secretary, and G. H. Atkin of Chicago, treasurer. The company, it is announced, will start with a number of contracts taken over from the Fischer Equipment Company. The company has taken a factory in Chicago, and it is proposed to establish another large factory in the vicinity of New York. It is also intended to manufacture in Canada. The New York office will be in the Wagner Palace Car building, Forty-fourth street and Vanderbilt avenue. Mr. Chandler, the secretary, is the son and has been the private secretary of President A. B. Chandler, of the Postal Telegraph Company. He is very enthusiastic and energetic as to his new field of work.

EXTENSIONS AT LYNN.—The purchase by the General Electric Company of 15 acres of additional land adjoining their present property known as the River Works, increasing their holdings to 40 acres, means a great deal to Lynn. It gives to the company greatly improved facilities for handling heavy freight, as they have a frontage of nearly half a mile along the tracks of the Boston & Maine Railroad. There is room for the location of foundries for the casting and shops for the finishing of heavy iron and steel parts of machinery manufactured by the company. Their front on the Saugus River enables them to ship goods by water as well as to receive the raw material in use at the River Works. More buildings and better facilities for handling the product of the works assumes additional working force and an increase in wage-earning capacity, which will directly benefit the men who will be employed and indirectly be an advantage to trade and the general prosperity of the city. The purchase of more land and the plans for greater business at the River Works is the most important move in the direction of added prosperity that has been made since the establishment of the River Works.

TROLLEYS FOR PORTUGAL.—A representative of the firm of Wernher, Beit & Company, bankers of London, is now in this country for the purpose of purchasing apparatus and material for the electric equipment of Portuguese trolleys. W. B. Rommel, who has been appointed chief engineer and general manager of the Carros de Ferro del Lisboa (Lisbon Tramways Co.) All the requisite equipment and material will be bought in the United States at a cost of $1,000,000. He has already placed contracts with the Lorain Steel Company of Lorain, O., for 2500 tons of rails, which will constitute half what will eventually be required for the Lisbon road. The General Electric Company of Schenectady, will furnish 75 car equipments, and the J. G. Brill Manufacturing Company of Philadelphia, will supply 120 car trucks. The question of the cars themselves has not yet been decided, and other portions of the electrical equipment are undecided at the moment.

AMERICAN TOOLS ABROAD.—An English machinist is quoted as follows by Mr. R. Fleming, U. S. Consul at Edinburgh: The improvements in these tools and the beneficial results from their adoption in this country have been tremendous within the last three or four years. No machine shop can now be well equipped without tools from the United States—lathes, shaping machines, planing machines, screwing machines, etc. These, not to attempt to enumerate the hundred kinds of hand tools, are being used everywhere throughout the British Islands. You may say that no machine shop worth mentioning in this country is without at least such tools as turret lathes and ordinary lathes of American manufacture. The turret lathe, which is made in many sizes, varying in price from $250 to $1000, is a typical example of the general convenience of American tools. With the ordinary British lathes, used for the same purposes, workmen lose time in substituting one tool for another which may not be readily found. The turret lathe obviates this delay. A full assortment of tools being fixed in its turret, the workmen can instantly get any tool by a slight turn of the turret.

THE COPPER MARKET.—Mr. Leonard Lewisohn, the New York metal broker, in discussing the copper situation last week, said: "The market for copper is in splendid shape. The comparatively high price has not cut any figure in consumption beyond a lessened demand for sheet copper for building purposes. For electrical purposes there is no falling off and there is not likely to be. The General Electric Company has so many orders it hardly knows what to do, and all the brass manufacturers of the Connecticut Valley have orders months ahead of their ability to produce. It is unfair to compare the present with the Secretan speculation. Then copper was the one metal that advanced. Secretan was a man of great theories, but lacked practicability. He saw the coming of the electrical age, but was years ahead of it. I do not anticipate any great change in the price of copper for the next six months, then it will depend upon conditions not now clearly seen. There is a probability, however, that the new forces in the copper producing industry will keep prices steady. Manufacturers are not adverse to present prices; they do want stability."

AHEARN & SOPER, electrical engineers and contractors of Ottawa, have been awarded a big contract by the Royal Electric Company of Montreal. The firm will supply the company with motors aggregating in all 3200-hp. These motors will be used by the Royal Electric in connection with its electric power works at Chambly, Que. The Dominion Cotton Mills Company, of Montreal, will henceforth run its large mills with electricity, instead of by steam as at present. The Royal Electric Company will supply the electrical power, and, as stated, Messrs. Ahearn and Soper will furnish the motors, which will be of various sizes. The latter firm have also been awarded another contract for 300-hp in motors in connection with the Dominion Oilcloth Company, of Montreal, which is replacing steam power with electricity. The Royal Electric has also entered into a contract with this company to supply power. Ahearn & Soper are the Canadian agents of the Westinghouse Company.

A WARNING AS TO PACKAGES.—The repeated warnings of the consuls to American exporters that they do not do business properly continue to be reinforced with every week's batch of consular reports. One from Consul Hayden, at Castellamare di Stabia, repeats the complaint that American exporters do not properly pack their goods. "Even when especially requested to do so," he declares, "they fail to give that attention to the matter which the necessity of the case demands." As an instance, he says that he had succeeded in starting what promised to lead to trade in American bicycles and tricycles, and he gave especial directions to securely box the machine ordered. "Instead of heeding the instruction," he says, "the machine was sent, not in a box, but in a crate, and all the tools were stolen in transit, which caused a delay of six weeks and the cost of another set of tools, as they could not be had here. This has occurred in five instances."

AMERICAN FOUNTAINS AT THE CRYSTAL PALACE, LONDON.—Some of the London newspapers gave recently a detailed description of the three electric fountains just started at the Crystal Palace, Sydenham, London. It would appear from these descriptions that the fountains are drawing enormous crowds to that already popular resort as although electric fountains have been known for some time in England, this is the first attempt of the kind in London. The fountains were designed and erected by Mr. F. E. Darlington, Philadelphia, Pa., and water is supplied to them by two vertical triplex power pumps, built by the Goulds Manufacturing Company, Seneca Falls, N. Y. These pumps are operated by electric motors and the whole outfit is so simple that it is practically controlled by merely touching a button. The installation of these electric fountains represents a first expenditure of about £15,000 ($75,000.)

THE SPRAGUE ELECTRIC COMPANY report the following recent foreign shipments: Twenty slow-speed motors, averaging 30-hp, with special attachments and belt conveyors for grain handling at the Bristol docks, England, worth some $15,000. A large plant was forwarded to Calcutta for the purpose of operating tools in the machine shops of the East Indian Railway, which is an Indian Government road. Several high-speed engines for driving Sprague isolated electric plants in Japan have also been shipped to the Bagnall-Hilles Company, of Yokohama. These engines have a capacity of 5-hp, weigh only 150 lbs. each, and run at 1800 revolutions per minute. They are intended to be directly connected to the Lundell generators. The company is in receipt of heavy Government contracts for ventilating apparatus for the Manila army transports, and is shipping quantities of fans to the Philippines via San Francisco.

GERMAN TRADE.—Figures received at the State Department from the German Bureau of Statistics through Vice-Consul General Hanauer, at Frankfort, show that last year Germany imported from the United States more goods and products than from any other country, the total being $208,785,500. In the same time the United States bought from Germany goods to the value of $79,611,000. Great Britain stood second among the nations from which Germany purchased and Russia third. Each of these nations purchased much more from Germany than did the United States. The total German foreign trade amounted to $1,295,554,860 in imports and $954,499,000 in exports. Mr. Hanauer says that there is a boom on in iron, steel, etc., due to railway work and in part to the construction of new trolley lines.

BULLOCK POWER PLANTS.—The Bullock Electric Manufacturing Company have just closed a contract for their apparatus for China, India, the Philippines and adjacent territory in Asia, from which they expect excellent results. A recent French contract for railway apparatus requires over $500,000 worth to be taken inside of five years. Reference was made recently in this department to their printing press equipments abroad. These "teaser" sets, it may be noted, include the Manchester Sporting Chronicle (5 equipments); Belfast Evening News (1 equipment); London Daily Mail (2 equipments); Nottingham Guardian, (1 equipment); Birmingham Daily Post (1 equipment); Aberdeen Free Press (1 equipment.) The superior economy of the "teaser" method accounts for its popularity.

GOLD MINING PLANT.—The Sawpit Gold Mining Company, operating in Navajo basin, Mt. Wilson district, San Miguel county, Col., has perfected its arrangements for the erection of an electric plant for the operation of the mine and mill. The machinery is now on the way and will be installed as soon as it arrives on the ground. The company is building a dam on the West Dolores river, about 2½ miles below the mine and mill. The plant will have a capacity of about 300-hp and all of the mill machinery as well as the compressor will be run by electric current. This is one of the first electric power plants installed in that part of the State.

HARRISON SAFETY BOILER WORKS report among recent sales 1500-hp for the Powelton Electric Company, of Philadelphia; 100-hp for the Greenville (Tenn.) Electric Light Company; 150-hp for the municipal plant, Elroy, Wis., and 20-hp for the municipal plant, Water Valley, Miss. Among orders for Cochrane separators are a 9-inch for the Cedar Rapids (Iowa) Electric Light & Power Company; 6-inch for the Gloucester County Electric Company, Pitman, N. J., and 6 and 7-inch for Burhorn & Granger, Philadelphia.

THE CROCKER-WHEELER ELECTRIC COMPANY report a pressure of foreign orders. Recent shipments include one 75-kw motor and one 35-kw motor, for driving blowers in the plant of the Smelting Corporation at Ellesmereport, Cheshire, England. Several 30 and 50-kw machines are being forwarded for Government work in Havana. Mr. Doremus, secretary of the company, is now in England negotiating some important contracts with large users of power in the manufacturing districts.

EXPORTS OF CAHALL BOILERS.—The foreign contracts recently obtained by Thayer & Company include several Cahall boilers, ordered by the South American Electric Company, which is erecting a large electric light plant in Buenos Ayres. The Sao Paulo Electric Light & Power Company, of Sao Paulo, Brazil, requires 800-hp to drive its street railway plant, and eight boilers, aggregating 1750-hp, are being shipped to Cuban and Mexican ports.

TELEPHONES FOR JAPAN.—The Kioto Electric Traction Company has recently equipped stations, offices, etc., with a complete telephone system. The apparatus was furnished by the Stromberg-Carlson Telephone Manufacturing Company, of Chicago, who have done a good deal of work already in foreign countries.

Special Correspondence.

NEW YORK NOTES.

New York, Oct. 2, 1899.

THE THIRD AVENUE ROAD is pushing ahead with some of its electrical work, and Westinghouse, Church, Kerr & Co. have received an order for two 600-hp Westinghouse compound engines, to be installed in the temporary power station at Third Avenue and 129th Street.

THE CHICAGO CONVENTION.—Messrs. H. H. Vreeland, J. H. McGraw and T. C. Martin, committee for New York, and C. S. Clark, committee for Boston, announce that the special train over the New York Central to the street railway convention at Chicago will leave this city on Sunday, Oct. 15, and Boston at 10:30 a. m. It will consist of Wagner vestibuled drawing-room sleeping cars and dining car. Applications for berths should be sent in at once.

STERLING LAMPS.—The Sterling Arc Lamp Company, 214-222 West Twenty-sixth Street, are very busy with their enclosed arcs for all circuits. They have recently issued a very neat and complete brochure on the subject of their product. They are now making lamps of 105-120 volts and 3-5 amp. constant potential; 70 volts, 5-7 amp. constant current series; 100-120 volts, 7200-16,000 alt. for alternating current; and series alternating lamps. Mr. J. Auerbach, the treasurer and general manager, shows with legitimate pride a big sheaf of orders and a big one of testimonials.

BOERNER & LOEWENTHAL, of 120 Liberty Street, have dissolved partnership, both members of the firm having received tempting offers. Mr. Max Loewenthal has become superintendent of the firm of Osterberg & Sutton, Bowling Green Building, and is already extremely busy on several plants. Mr. Boerner has been appointed chief engineer of the Galvanic Metal Paper Manufacturing Company, of 725 Broadway, whose metal packing and commutator brush were described not long since in these pages.

ELECTRIC LIGHTING IN HOBOKEN.—The United Electric Company, of New Jersey, has recently absorbed the North River Light, Heat & Power Company, of Hoboken, started by Mr. A. K. Bonta, once of the old company, and the plant has been sold off. The offices of the United Electric Company of New Jersey are at Market and Beaver streets, Newark. The company have just purchased a quantity of power machinery for their various plants, including two 600-hp Morrin boilers for use in Jersey City. For their Hoboken plant they have ordered five 700-hp Babcock & Wilcox boilers, two 1500-hp Pennsylvania Iron Works engines and two 1500-hp Corliss engines from the International Power Company, of Providence, R. I.

THE SAO PAULO PROJECT.—Under the direction of Hugh L. Cooper, a force of 12 civil and electrical engineers sailed last week from this city on the Lamport & Holt Line steamer Coleridge for Rio Janeiro, Brazil. Thence they will travel inland to the city of Sao Paulo, where they will commence the gigantic work of damming the Tiete River, 23 miles above the city, to obtain power to operate an electric plant for supplying Sao Paulo with a street railway and electric lights. The engineers represent the Sao Paulo Railway, Lighting & Power Company, Limited, incorporated about a year ago under the laws of Canada, and controlling $5,000,000 of United States and Canadian capital. Col. G. B. M. Harvey and Frederick S. Pearson, of New York, are largely interested in the project. The men backing the enterprise constitute the so-called Ross-McKenzie syndicate. William McKenzie, president of the Toronto Street Railway Company, is temporary president of the Sao Paulo Company. A number of details as to contracts placed for material have already been given in this paper. Nearly all the provisions and tools required will be taken from the United States. A shipment of tools valued at $40,000 was sent on Sept. 15 and another on Sept. 25.

NEW ENGLAND NOTES.

Boston, Sept. 30, 1899.

THE BULLARD MACHINE TOOL COMPANY, of Bridgeport, Conn., have let the contract for a new blacksmith shop 40 feet wide and 60 feet long. The side walls are of brick, and the roof trusses have a clear span and are made of steel. The Berlin Iron Bridge Company, of East Berlin, Conn., have the contract for the entire building.

MR. S. B. CONDIT, JR., of Boston, is now representing the Northern Electric Manufacturing Company, of Madison, Wis., and has already sold quite a number of their machines, which are giving excellent satisfaction. Mr. Condit also represents the Safety Armorite Conduit Company, of Pittsburg, Pa., and reports that this form of conduit has taken a firm hold on the Eastern market, and that the outlook is very bright.

AUTOMOBILES IN PARKS.—In response to a petition of the New England Electric Vehicle Company for permission to operate electric carriages in the Boston park system, the Boston park commission gave a hearing last week to that company, and all other persons interested in the subject. The park commission recently made a rule prohibiting the operating of motor carriages in the park system between the hours of 9 a. m. and 4 p. m. The matter was argued pro and con and then taken under consideration.

USE OF AUTOMOBILES.—Mr. D. A. Clark, president of the Crouch Automobile Manufacturing & Transportation Company, Baltimore, has just received an order from the chief of electrical construction of the Public Buildings Department, Boston, for an aluminum-bodied, wooden-wheel and rubber-tire steam carriage, for which $900 is to be paid. The city has bought four machines—one electric, one gasoline, one Stanley and one Crouch. These four will be thoroughly tested, and the best will be selected. This selection will determine the purchase of the other machines.

BELL TELEPHONE.—The Bell Telephone instrument statement for the month ended Sept. 20 shows:

	1899.	1898.	1897.	1896.
Gross output	56,698	31,977	19,198	12,042
Returned	20,073	12,931	7,105	7,030
Net output	36,625	19,046	12,093	5 012
Since Dec. 20.				
Gross output	488,737	244,724	162,743	148,395
Returned	145,227	108,259	69,109	68,547
Net output	343,510	136,465	93 637	79,848
Total outstanding	1,468,760	1,055,586	867,468	756,384

THE BOSTON EDISON COMPANY.—With regard to the new capital of $750,000, Mr. C. L. Edgar states that his company intends to spend it in improving its Atlantic Avenue property. The station, only one-third finished as yet, is to be completed; $300,000 will be spent in extending the engine room, boiler room and coal sheds; $150,000 on eight new boilers, four in the old station, four in the extension; $200,000 for two new engines and dynamos of 20-hp each, and $100,000 for a new and powerful storage battery. During the next year or two the company expects to spend, out of undivided profits of $150,000 a year, $300,000—$100,000 for a storage battery in the market district, and $200,000 on underground work. Of late it has laid practically no mains, many duct lines, however, have been constructed.

BOSTON ELECTRIC LIGHT COMPANY.—The gas and electric light commissioners gave a hearing this week to the petition of the Boston Electric Light Company for an increased issue of $500,000 stock, making capital of the company $3,000,000. New stock is desired to meet expense incurred or to be incurred from the construction of underground conduits, connections to its principal power house in South Boston, and general improvements and enlargements of the company's property. The petitioners were represented by Counsel Everett W. Burdett. He stated that the company had expended in the period from Jan. 1, 1898, to Sept. 1, 1899, a sum of $1,706,311. The expense has partially been offset by the last increase issue of stock made a year ago, from which $807,312 was realized, leaving an actual expense of $898,900 to be met from new stock issue. Bills outstanding are: For steam plant, $15,000; electric plant, $172,500; building, $14,000; underground conduits, $43,000; for underground work necessary to be ordered, $75,000, and for engines, dynamos, etc., necessary to be ordered within the next four months, $24,000, making a total obligation now outstanding and to be incurred in the future of $1,458,000. The company wish to capitalize only one-third of the expenditures. The financial statement shows gross earnings from Jan. 1 to Sept. 1 of $506,000, net $391,361, surplus $159,261. The company will realize a considerable sum from the sale of real estate on Summer Street and Fort Point Channel to the city for a new highway which will be added to improvement account. The company desire that the commissioners issue an order for sale of new stock at such a premium that present stockholders may receive new shares at a basis of one share new for five shares now outstanding.

THE CONNECTICUT TROLLEY TRUST.—One hears a good deal in New England nowadays about this pushing and progressive concern. Thus far the companies taken into the combine are the Norwalk Street Railway Company, the Central & Electric Railway of New Britain, the Waterbury Traction Company, the Housatonic Power Company, the Naugatuck Electric Light Company of Naugatuck, the Norwalk Gas Company, the Norwalk & South Norwalk Electric Company, the Greenwich Gas & Electric Light Company, and the Southington & Compounce Electric Road. Other companies with whom the promoters of the trust are at present negotiating are the Bridgeport Traction Company, the Milford Street Railway Company, the Derby Street Railway Company, the Bristol & Plainville Company, and the Shelton Street Railway Company. When the great power plant on the Housatonic is completed the various trolley lines and electric light plants will be run from the Housatonic River. When in operation the Connecticut Lighting & Power Company will run cars and light cities covering an area of nine hundred square miles, and all this will be managed from the power plant. This tremendous undertaking will cost over $6,000,000. An issue of $5,000,000 in stock and $5,000,000 in 4½ per cent. fifty-year bonds will be made now within a month. The backers of the Connecticut Trolley Trust are well known Connecticut and New York financiers and railroad men. Among them are A. M. Young, of Waterbury; Thomas Wallace, Thomas L. Cornell, R. S. Hinman, D. S. Brinsmade, Robert F. Gaylord and Allen W. Paige, and a syndicate of New York and Connecticut financiers, including R. A. C. Smith, H. G. Runkle, E. N. Gibbs, S. S. Sheehan and D. J. Hampton, of New York; Samuel Fessenden, of Stamford; George E. Terry, of Waterbury, among others.

PHILADELPHIA NOTES.

Philadelphia, Oct. 2, 1899.

THE RIO PLATA ELECTRIC RAILWAY COMPANY of this city has been incorporated, with a capital stock of $100,000.

LUCAS & GLIEM have an order from the Fidelity International Company for a plant at Berkeley, Va., including two large generators of 275-hp, a 40-kw generator for lighting and 9 motors.

HOLMES FIBRE GRAPHITE MANUFACTURING COMPANY are now comfortably settled in their new factory at 5155 Wakefield Street, Germantown, with modern machinery equipment, and invite calls, inquiries and orders.

BETHLEHEM, PA.—A charter has been issued by the State Department to the County Central Street Railway Company of Bethlehem, to build a line five miles long in Northampton County. The line will be operated by electricity. The capital stock is $30,000.

CONGRESSES.—The Commercial Congress to be opened in connection with the National Export Exposition on Oct. 10 promises to be a great success in so far as representative attendance is concerned. During this week, the Franklin Institute will also celebrate at the Exposition its seventy-fifth anniversary with a long series of exercises.

AMERICAN ELECTROLYTIC COMPANY, of this city, has been formed with a capital stock of $100,000 to investigate and develop electrolytic processes.

THE PHILADELPHIA MACHINE SCREW WORKS, of this city, report that their business was never better than at the present time. They are exceedingly busy with general screw and electrical work, and owing to the fact that they have recently largely increased their plant, they are better enabled now to fill orders promptly than heretofore.

UNION TRACTION EXTENSIONS.—Authority has been granted for the extension of the Seventh and Ninth Streets road from its present terminus at McKean Street to Jackson Street and for building a new road on Island Road, from Woodland Avenue to Eastwick Avenue; also a crosstown line, beginning at Fifty-second and Lancaster Avenue and running to Woodland Avenue. The distance of these lines will be about five and a half miles, and it is believed will be valuable feeders to the system.

THE COLUMBIA CLUB has its fifth annual outing on Saturday this week to Gettysburg. Last year the excursion included nearly 100 members. The Eagle Hotel will be headquarters and the usual campfire at the College will be held in the evening. Five of the party going were actually engaged in the great decisive battle. Mr. L. Teal, of the S. S. White Dental Manufacturing Company, is secretary and treasurer, and modestly writes himself down as one of those who were at Gettysburg—twenty years after the battle. It will be a splendid two days' holiday.

DELAWARE.—The Delaware General Electric Railway Company, which has secured the franchises in Kent County, has completed its preliminary drawings, and filed its surveys with Secretary of State Hughes. The five days of grace allowed the Delaware Electric Company, of which ex-Secretary of State John H. Hawkins is the head, and which once controlled the franchises, expired, but no move was made toward removing the tracks already laid, as was ordered.

FERRACUTE MACHINE COMPANY.—One of the best mechanical exhibits at the Export Exhibition is that of the Ferracute Machine Company, of Bridgeton, N. J., whose products and machinery are known around the world. It is in charge of Mr. Fred. Smith. The attendants have been running the presses steadily, turning out the dainty little souvenirs, and also the official badge or medal of the Exposition, for which they have the contract. The exhibit consists of nine presses, with dies and attachments necessary for making the aluminum, tin, brass, bronze and nicoline articles. The most interesting press of the exhibit is probably the coining-press, giving 150 tons pressure, which is used for embossing and coining the badges and medals, etc. There is also a large double crank-press, for cutting large sheet-metal articles such as disks, tinware, etc.; a recently designed machine, for notching armature disks for electrical work, cutting presses, punching presses, drawing presses, etc., etc.

CHICAGO NOTES.

Chicago, Sept. 30, 1899.

TELEPHONE CONDUITS.—The Illinois Telephone & Telegraph Company, of Chicago, have received a permit to build a conduit 4 by 7½ feet at a depth of 25 feet below the surface of the ground, to be used for telegraph and telephone wires only.

McGANN TO TRACTION COMPANIES.—Mr. McGann, the Commissioner of Public Works, has issued a letter to the several street railway companies of Chicago calling on them to repair more than one hundred sections of streets in which their tracks are laid and ordering them to remove unused tracks from the business centre of the city.

AUTOMOBILE SHOW.—The first exhibition of automobiles ever given in the West will open at Tattersall's Thursday evening next. Arrangements for the show have been under way for over a month, and yesterday a sufficient number of exhibitors was secured to guarantee a success. Nearly all of the big automobile manufacturers of the United States have agreed to exhibit. The building has been put in condition for the exposition. A force of workmen will begin placing the machines in order, and by Wednesday evening all arrangements for the opening will have been completed.

GUARANTEE ELECTRIC COMPANY.—This concern owns the entire works of the Standard Electric Company, fitted up by the latter at an expense near $75,000, and in the reorganization as its successor has put this figure at $35,000. The guarantee company's capital, full paid, is $50,000. Part of the business consists in handling repair parts and supplies for Standard plants, but its chief work will be the buying, selling and repairing of electrical apparatus of all kinds. It has every tool necessary for handling and testing any machine. The guarantee company also has a nice plant manufacturing arc lamps, 64,000 square feet of floor space and 200-hp steam. Mr. Chas. E. Gregory is president and Mr. G. B. Shaw secretary and treasurer.

PITTSBURG NOTES.

Pittsburg, Sept. 27, 1899.

ALLEGHENY CITY HALL has installed an electric clock, which is said to be a recent invention of Mr. Elmer Loomis, the city electrician of Allegheny.

MR. LAWRENCE CARGO, representative of the Westinghouse Electric & Manufacturing Company in Denver, Col., has been in this city for a week visiting his many friends.

MAJOR J. B. POLLITT, Captain Harry Pollitt and Mr. Thomas Parker, all of England, have been in this city for a week inspecting the plants of the Westinghouse Company at East Pittsburg.

PROFESSOR REGINALD A. FESSENDEN, assisted by Professor S. M. Kinter, of the Western Pennsylvania University, is making experiments in wireless telegraphy. He has discovered that electrostatic lines in passing down the poles where the instrument is located will produce a current which can be made to pass through the primary of a transformer and a higher voltage can be taken from a secondary, producing a large spark.

THE PITTSBURG INDUSTRIAL EXPOSITION, which is held in this city every year, was opened a few days ago, and, as usual, the latest developments in the construction of electrical apparatus are on view. The Westinghouse Company, as the local concern, is largely represented in an exhibit of generators, motors and switchboard appliances. A practical demonstration of the utility of liquefied air is also one of the attractions. There are a number of electric motor carriages.

OHIO NOTES.

Cleveland, Sept. 30, 1899.

THE DEVERE ELECTRIC COMPANY has secured the contract for wiring the horse show buildings at Oakley.

THE CLEVELAND & EASTERN ELECTRIC RAILWAY, operating from Cleveland to Burton, has opened for business.

THE DAYTON RAPID TRANSIT COMPANY has been granted a franchise for a new electric line through that city.

MR. L. G. LILLEY, for several years in charge of the electrical department of the Cincinnati Underwriters' Association, has associated himself with A. G. Schulman, the contractor.

SPRINGFIELD TO COLUMBUS. The Springfield & Urbana Electric Railway Company is preparing to build an extension from Springfield to Columbus, making a sixty mile road.

BUSINESS MANAGER WM. A. McCALLUM, of the Electric Railway Equipment Company, has just closed a contract for street railway equipment for use in various parts of Mexico.

TOLEDO, O.—The Toledo, Monroe & Trenton Electric Railway Company has been granted a thirty-year franchise through Monroe. Work on the road will be commenced in the near future.

THE CLEVELAND CITY RAILWAY COMPANY has secured twenty-five year franchises for two new lines from Cleveland to Rocky River. The company already has one line to that and the franchise on this has been extended six years.

THE CLEVELAND & CHAGRIN FALLS ELECTRIC RAILWAY COMPANY is enlarging and greatly increasing the capacity of its power house at Chagrin Falls. This has been made necessary by the completion of a new line from that place to South Newberry.

THE COMMERCIAL ELECTRIC COMPANY, of Painesville, has been incorporated for $25,000 to furnish heat, power and light in that city and surrounding towns. The incorporators were Thomas E. Durban, Walter E. Malin, Will N. Callister, F. W. Littlejohn and John Malin.

OBERLIN TO NORWALK.—The Cleveland, Berea, Elyria and Oberlin Electric Railway Company is surveying for a new line from Oberlin to Norwalk, and the road will be built at once. This will form a connecting link with the line which is being built from Toledo to Norwalk. Another line is contemplated from Oberlin to Wellington.

MASSILLON TELEPHONY.—The plant of the Farmer's Telephone Company at Massillon and the toll lines to the various villages near by have been purchased by the United States Telephone Company, of which H. A. Everett, of Cleveland, is president. The consideration is said to have been $20,000. The United States Company is strongly opposing the Bell Company in that section, and has recently purchased several small independent lines, which are soon to be united.

THE CONSOLIDATED STREET RAILWAY COMPANY, which has control of the electric railways in this bailiwick, is threatened with a strike. President John Kilgour has refused to accede to nine separate requests of the motormen and conductors and says he will have no conferences with the men as long as they have in their organization any outside men. Among the more important requests preferred by the men is the privilege of sitting down certain hours during the day between points to be mutually agreed upon, and 20 cents an hour for their work.

COST OF A STRIKE.—The fact that the strike on the lines of the Cleveland Electric Railway has been a source of great loss to the company was shown at a meeting of stockholders, when it was announced that the regular quarterly dividend would not be paid. For four years up to October, 1898, a quarterly dividend of ¾ of 1 per cent. was the rule, and since that time, with but one exception, 1 per cent. has been paid each quarter. The total amount paid in dividends is about $1,770,000. On the other hand, the stock of the Cleveland City Railway Company is in great demand, and its value is increasing almost daily. A large block changed hands a few days ago at 103¼, the highest price ever paid. A dividend of 1 per cent. will be declared in the near future.

LOWER CAR SPEEDS.—The police department of Cleveland has again instituted a crusade against motor men on city railroads who exceed the speed limit of twelve miles an hour. Since the labor troubles on the Cleveland Electric Railway the old hands have been superseded largely by inexperienced men, which together with the fact that the running schedules have been reduced, has greatly increased the number of accidents. The cope ordinance regulating the style of brakes to be used on street cars is evidently a dead letter. Mayor Harley, when the ordinance was passed, announced that it must be obeyed to the letter, but more than two weeks have elapsed since it went into effect, and no attempt has been made, either to obey or enforce it.

THE EASTMAN ELECTRIC VOITURETTE, described and illustrated in a recent issue of this paper, is to be manufactured and sold by the Automobile Carriage Supply Company, of Cleveland, the Eastman Company having closed a deal to that effect. A number of these vehicles are under process of con-

struction. The automobile club house, which is to be conducted by the same concern, is rapidly nearly completion. In addition to all the appurtenances of an up-to-date club house, there are a riding school, repository, repair shop, sales room and plant for manufacturing and assembling motor vehicles. The formal opening of the club will take place in the near future. A new feature of the institution which has just been announced will be a line of automobile buses, which will be at the disposal of club members, calling at their homes at any hour desired and taking them to their place of business.

Cincinnati, O., Sept. 30, 1899.

MR. A. G. SCHULMAN has just secured the contract for wiring the Masonic Temple, on Third Street. This, one of the largest and most important business structures on the street, is in process of remodeling. The contract will approximate $1000.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has just placed for the South Covington & Cincinnati Electric Railway Company a 1200-hp direct connected generator operating with a C. & G. Cooper's Corliss 80-revolution engine to drive the various lines of that road.

E. M. LAWTON, of the Lawton-Beattie Electric Company, states that the recent combination of supply people effected at the St. Nicholas Hotel here is proving a success already. The system put into operation has tended to diminish the great number of inconsequential construction men, and credits are being put upon a much more satisfactory basis.

BUSINESS MEN'S CLUB.—No other set of men took a more enthusiastic interest in the election of the Business Men's Club last Thursday than the electric trade. C. B. Humphreys, of the Westinghouse Electric Company, was on the blue or independent ticket for director, and all the larger supply houses and jobbers lined up solidly for him. That their help was effective is seen in the result. He received the highest vote of his ticket in the directors' class, which was no inconsiderable compliment when it is understood that all the red or regular directorial candidates were elected.

"ELECTRIC CORNER" at the Business Men's Club is daily becoming more noteworthy. W. F. Hays, of the General Electric Company; E. M. Lawton, of the Lawton-Beattie Company; T. J. Ryan, of the Siemens-Halske Company; H. S. Rogers, consulting engineer of the General Electric Company; C. E. Jones, of Jones Bros.; C. B. Humphrey, of the Westinghouse Company; Frank D. Lawrence, of the Standard Electric Company; Samuel Glover, of the Post-Glover Company, and F. H. Strieby, of the General Electric Company's mining department, constitute a pretty solid aggregation of citizens.

MINNESOTA NOTES.

Minneapolis, Sept. 30, 1899.

DRUGGISTS' TELEPHONES.—Several weeks ago the general manager of the Northwestern Telephone Exchange Company refused to make connections for the telephones in drug stores in Minneapolis, except at the call of the proprietor or one of his employees. It was an attempt to force the druggists to use "nickle in the slot" telephones. The order continued in force a few days and then was dropped temporarily. The Association of Druggists deferred action till a later date, when they hope to be able to get service from the new company.

J. C. HUBINGER, of Keokuk, Iowa, proprietor and general manager of the Mississippi Valley Telephone Company, was in Minneapolis this week and will probably spend the next two weeks here personally looking after the installation of the new exchanges both here and in St. Paul. Mr. Hubinger is well pleased with the progress of the work in this city and intends to push it as fast as possible from now on. The first 1200 telephones will be in operation some time next week. A large number are already connected and "central" is being kept busy by the anxious subscribers who wish to know when they can get their connections. He has made arrangements in Chicago for the manufacture and shipment of additions to the present switchboard, which will add 1500 telephones to the capacity. The new board will probably arrive within the next six weeks, and additional sections will be hurried on after that as fast as possible. Four hundred thousand dollars has already been spent upon the construction of the exchanges in the twin cities.

ST. LOUIS NOTES.

St. Louis, Mo., Sept. 30, 1899.

$45,000,000 NOW.—An increase of $45,000,000 in the capital stock of the United Railways Company was effected at a meeting of the board of directors last week. The new capitalization is authorized under the street railway consolidation law passed by the State Assembly last winter, and is made for the purpose of enabling the company to take charge of its new property.

THE ALTON RAILWAY, GAS & ELECTRIC COMPANY last week filed a bond for $10,000 with the city Comptroller of Alton, Ill., as one of the provisions of the franchise granted it the right to construct what will be known as the Cemetery street railway. The filing of the bond was the last act before beginning the actual construction of the road, which will be commenced at once.

NEW ELECTRIC RAILWAY.—The construction of an electric railway between Granite City, Ill., and Horse Shoe Lake, a well known resort five miles east of that city, is being agitated by St. Louis capitalists. W. D. Depew and J. R. Perkins, of St. Louis, have published an application for a franchise. The proposed line will connect with the Mississippi Valley Electric and the Venice, Madison & Granite City Railway Company.

A NEW EAST SIDE RAILWAY.—Articles of incorporation of the St. Louis, Troy & Eastern Railway Company were filed Sept. 19 with the County Clerk at Edwardsville, Ill. The corporation is formed for the purpose of building an electric line from East St. Louis to Collinsville, Ill. The new company is capitalized for $300,000, and is to have headquarters in East St. Louis and limited to fifty years. The incorporators are W. S. Forman, D. M. Browning, S. D. Sexton and Mayor M. M. Stephens, of East St. Louis; C. N. Travous and W. M. Wavnack, of Edwardsville, and W. G. Burroughs, of Collinsville. The new company will also possess the assets of the Madison Railway Company, which consists principally of a right of way from Venice to Collinsville.

A SUIT IN REPLEVIN was filed in the United States Circuit Court for the Eastern District of Missouri Sept. 20 by the National Carbon Company of New Jersey against Samuel G. Booker and the Phoenix Manufacturing Company, of St. Louis. The petition alleges that the defendants are in possession of personal property worth $20,000, which belongs to the plaintiffs, and they ask a judgment of the court awarding it to them. A writ of replevin was issued by the clerk of the court and placed in the hands of the marshal for service. After the plaintiff had given bond for $40,000, the writ was served on the defendants, and the property seized. The factory is located at from 2120 to 2140 De Kalb Street. The defendants deny that the goods seized belong to the plaintiffs, and will defend the suit. The officers of the Phoenix Battery Company are S. M. Dodd, president; H. L. Page, secretary, and treasurer, and S. G. Booker, manager, well known in the electrical industry.

SOUTHERN NOTES.

Memphis, Tenn., Sept. 23, 1899.

THE SOUTHWESTERN TELEPHONE COMPANY are preparing to place a cable on the Mississippi River bridge at this place, which will give them more direct lines east.

MR. E. H. TAYLOR and associates are putting in a telephone exchange at Bolivar and Whiteville, Tenn., with lines running to small places near by. The company will be chartered as the Progress Telephone Company, with headquarters at Bolivar.

GENERAL S. T. CARNES, president of the Memphis Light & Power Company, and of the National Electric Light Association, has just purchased one of the finest residences in this city, for a home. It is situated on Linden, Wittington and Pontotoc Streets, in the best residence part of the old City of Memphis.

OXFORD, MISS.—The citizens of Oxford, Miss., the county seat of Lafayette County, are agitating the question of an electric lighting plant. Oxford is one of the best towns in North Mississippi, and a great educational centre. There is at present an independent telephone exchange of 130 instruments, managed by Mr. J. R. Shissault.

THE DICKERVILLE, OSCEOLA & EASTERN ARKANSAS RAILWAY COMPANY are building a telephone line along their right of way, between Dickerville and Osceola, Ark. It is also reported that this company will operate the Tennessee, Arkansas & Missouri line, touching river points between Osceola and Hopfield, Ark., and will put it in first class condition for business.

Austin, Tex., Sept. 25, 1899.

TELEPHONY.—The charter of the Southeast Texas Telephone Company has been filed in the secretary of state's office at Austin, Texas. The principal office of the company is at Corrigan, Polk County, Texas, and its capital stock is $10,000. Its purpose is to construct and maintain telephone lines between Beaumont and Trinity, Texas, connecting with a number of intermediate towns. The incorporators are John H. Traylor, James H. Allen and J. T. Elliott.

MUNICIPAL PLANTS.—Austin, Texas, is experiencing another very trying period with the municipal electric light and power plant of that city. For the second time within twelve months the water supply in Lake McDonald has become exhausted to such an extent as to necessitate the shutting down of the electric and power plant. As a result of this action all customers of the city's plant are without electric lights, and, added to this severe inconvenience is the fact that the electric street railway systems which obtained power from the city's plant have been forced to substitute temporarily the antiquated mule power for electric traction. It has been discovered that the rapid receding of the waters in Lake McDonald is not due wholly to the prolonged drouth, but that a big volume of water is escaping through an eight-foot leak in the dam. An effort is now being made to stop this leak. The dam was constructed several years ago at a cost of $1,000,000. The cost of the power house and waterworks plant was an additional $600,000. The enterprise has not been a success, and the city has a big load to carry. It is likely that an auxiliary steam plant will be installed to meet such emergencies as now exists.

Baltimore, Md., Sept. 29, 1899.

THE McCAY ENGINEERING COMPANY have recently disposed of their regulating socket to the Columbia Electric Supply Company, having discontinued the manufacture of the socket, and have begun the manufacture of heating appliances covered by patents issued Geo. H. Whittingham, which patents they have recently acquired. These heating appliances are known for their toughness and durability. They are so built and so constructed that they will readily stand an over load from 50 to 100 per cent. Many of the car lines in Baltimore and other cities are now heating entirely by this form of heater. These forms are made in a radiator form exactly like steam radiators, which makes it very easy to estimate the square feet of heating surface; and they are made up in regular styles of 8, 10, 12 and 24 square feet of heating surface. They are built either for alternating or for direct current, present a very neat appearance, and are very highly finished. The company also manufacture heating appliances such as tailor irons and laundry irons; and make a special form of coil heater for heating fluids. These coils are placed directly in the fluid, and the total amount of energy is transferred to the fluid to be heated. This makes a very neat and compact form for heating any fluid. The company also makes a special iron for use in hat factories, which has received very favorable commendation wherever used. They are now filling a large order for one of the big tailor establishments in Baltimore, and look for a very heavy demand this fall for their appliances.

PACIFIC COAST NOTES.

San Francisco, Cal., Sept. 25, 1899.

A TELEPHONE LINE is in course of construction to connect Astoria, Ore., with the Government buoy station at Tongue Point, on the Columbia River.

THE YUBA ELECTRIC POWER COMPANY of California, is now supplying a large amount of current to the Sacramento Electric, Gas & Railway Company, the contract authorizing 5000-hp.

JAMESTOWN, CAL., DRY WEATHER.—Some of the electric power plants in the vicinity of Jamestown, Cal., have been affected by dry weather, but the shortage of water is less than that of last year.

THE UNION IRON WORKS COMPANY now has electric overhead traveling cranes each of forty tons capacity in use in the sheds over the slips in the shipyard. They are turned out complete by the works.

MR. P. A. REGER, who formerly conducted an electrical supply house in San Francisco under the name of Reger & Atwater, has recovered his health, and is acting as agent for electrical goods with his office at 537 Mission Street.

THE TACOMA RAILWAY & POWER COMPANY, which owns the consolidated street railway lines of that city, has filed a mortgage for $1,500,000 on its property. The Old Colony Trust Company, of Boston, holds the mortgage. Improvements will be made with the money.

THE SAN FRANCISCO GAS & ELECTRIC COMPANY will receive the street lighting contracts for the current year, and also those for lighting the public buildings of the City and County of San Francisco. The competition introduced by the Mutual Electric Light Company, which now has the right to erect poles in certain districts reduced the contract price in the competitive localities about 50 per cent. Both gas and arc lights are to be used to illuminate the streets.

THE STANISLAUS WATER COMPANY will, it is said, install a large electric power plant at Six Mile Bar, between Knight's Ferry and O'Brien's, Cal., where a massive cement dam is now being constructed. Mines and mills in Calaveras County will be reached first by the company's lines, and Stockton could be supplied with current later on. Mr. Charles Tulloch, the Oakdale miller, is interested and Mrs. C. D. Lane. The Lane mines and the Oakdale mill will be operated among others. A large amount of real estate and water rights has been acquired by the company.

AUTOTRUCK.—It is reported that Howard P. Taylor, has made arrangements to organize the California Autotruck Company, in San Francisco. It is said that Joseph Leiter, of Chicago, will be president of the corporation; J. H. Hoadley, of New York, vice-president; the Bank of California, treasurer, and H. P. Taylor, secretary and manager. The directorate will be composed of San Francisco business men, who have already subscribed $100,000 of the preferred stock. The capital stock is to be placed at $5,000,000. Mr. Taylor expects to place 200 automobiles in operation in the city before Jan. 1, next.

WESTERN NEW YORK NOTES.

Buffalo, N. Y., Sept. 30, 1899.

THE INTERNATIONAL TRACTION COMPANY has been making some changes in its Buffalo office. Frederick Slocum, who has been a clerk in the Power City Bank at Niagara Falls, has received an appointment as cashier.

TELEPHONY.—The new independent telephone company in Niagara Falls is hustling things to get its exchange in operation. The Bell company already feel the effects of the popular opposition and are advertising for business in the local papers.

NORTH TONAWANDA is now lighted by power from Niagara Falls. The first street circuit was turned on on the evening of September 18th, and the second Thursday night following. In a few weeks the new system will entirely replace the old. New machinery is to be installed in the North Tonawanda transformer station.

A NEW HAIR CLOTH FACTORY, on Elmwood Avenue, of which enterprise James E. Rock is the business head, is among the new consumers of power supplied by the Niagara Falls Hydraulic Power & Manufacturing Company, in Niagara Falls.

THE NIAGARA FALLS POWER COMPANY announces its intention to build a new power transmission line from Niagara Falls to North Tonawanda and from that point to Lockport. Between the Falls and North Tonawanda the new pole line will be erected along the route of the present pole line, the company owning a strip of land 30 feet wide. Next summer the company will extend this new line to Buffalo. When the new transmission service is placed in operation the present line will be used exclusively for Buffalo transmission, whereas it now supplies several points.

A LOOP ROAD.—The commissioners of the New York state reservation at Niagara have given their consent allowing the International Traction Company to lay a single track through the centre of Riverway, between Falls Street and Niagara Street, on the state reservation, in order that the New York and Canadian lines of the International Traction Company may be connected at the end of the upper steel arch bridge, thus completing the loop railway about the gorge. This question now goes to the Land Commissioners of the state, and if approved by them, as no doubt it will be, the laying of tracks may commence. For the consideration so granted, the International Traction Company will put down the track and will pay an annual rental of $1000.

THE ACKER PROCESS COMPANY, of Niagara Falls, will soon let a contract for a large new building to be a part of the new plant they are erecting on the lands of the Niagara Falls Hydraulic Power & Manufacturing Company. This building will stand to the rear of the buildings now being completed, and in order to get a site it has been found necessary to clear the land of several small concerns, among them a plant of the Barber Asphalt Company, which has been moved to Buffalo. The erection of the building may also necessitate the Niagara Gorge Road changing the route of its tracks slightly. While it is likely to be spring before the Acker Process Company gets down to having an output, still they are nearly ready for the initial electrical connections. The buildings already erected by this company are of most substantial nature and have a large floor space.

NIAGARA POWER IN CANADA.—The Canadian Niagara Power Company has awarded the contracts for sinking test holes along the route of the tunnel which it is the company's intention to build on the Canadian side of the river at Niagara Falls. These test holes will be sunk that the nature of the rock through which the tunnel will pass may be ascertained for the benefit of the company and also so that definite information may be given to bidding contractors. In depth the test holes will be 200 feet, while the diameter will be 4½ inches. The holes will be sunk with a diamond drill and a core of the rock brought to the surface for inspection. When the Niagara tunnel on the New York side was projected similar test holes were sunk. When the contracts were let, these test holes were followed by shafts, and from these shafts the work of blasting out the tunnel headings progressed until the big hole was completed. Up to this time the Canadian Niagara Power Company has not stated the size that the tunnel is to be, but it is more than probable that its dimensions will be large enough to provide for a very extensive development.

CANADIAN NOTES.

ONTARIO NOTES.

OTTAWA TO BROCKVILLE.—Promoters will apply at the next session of Dominion parliament for the incorporation of a company to construct a railway between Ottawa and Brockville, Ont., to be operated by electricity.

THE ELECTRIC STREET RAILWAY COMPANY, of London, Ont., has served notice of action against L. Jones Park, police magistrate, and John D. Wilson, mayor, to recover $20,000 damages claimed to be due for alleged licensing of buses to the striking employees of the company.

ALMONTE, ONT.—The by-law which was submitted to the rate payers of the town of Almonte, Ont., on the 25th of Sept., for the municipal ownership of the electric lighting plant of that town, was rejected by a majority of 38 votes.

THE GRAND FALLS ELECTRIC WORKS.—Senator Proctor, of Vermont, who is interested in the proposed pulp and electric works at Grand Falls, N. B., states that surveys have been made and that Montreal engineers are now at work upon plans of mills, dams, canals, etc.

THE HAMILTON SCREW WORKS, of the city of Hamilton, Ont., is another convert to electrical power, having shut down its steam plant. It is being supplied with power from the wires of the Cataract Power Company. The Royal Electric Company, of Montreal, is installing one of its 40-hp. S. K. C. two-phase motors.

GEORGE W. GOODWIN, of Kingston, Ont., writes to a Picton paper suggesting that an electric railway be built from Glenora to Picton, the Sand Banks and thence skirting the shores of Lake Ontario to Wellington. This route, the writer thinks, would be an attractive one for tourists. He predicts that citizens of Kingston would subscribe $250,000 stock, Picton $200,000 and Deseronto $50,000.

THE OTTAWA CAR WORKS, of Ottawa, Ont., has received a number of inquiries from prominent citizens as to the cost of automobiles. The indications are that next year a number of automobiles will be in operation in the streets of the Canadian capital, not only as private conveyances, but as delivery wagons for merchants, police patrol wagons, ambulances and possibly for experiment in the fire service.

A COMPOUND FRICTION CAR BRAKE has been invented by J. H. K. McCollum, of Toronto, Ont., and is now being used on some of the cars of the Toronto Street Railway. The brake can be applied to the axle of any car, and obtaining its power from the momentum of the car, costs nothing to operate. Patents have been secured in United States and Canada and a company formed to exploit the invention.

THE CATARACT POWER COMPANY has offered to furnish electric power to pump the water supply of the City of Hamilton, Ont., by electricity. The company offered to supply electric power at such a figure that the proposed increase in the water service and a continuous fire pressure could be secured at a less figure than the city is paying at present. If the city makes a contract for 20 years, the company will supply the necessary new pumps, motors, buildings, water main, etc., at actual cost. According to the Cataract Company's offer, it is estimated that it would effect a saving to the city of $1400 a year.

THE RAGGED RAPIDS.—Orillia electric power transmission scheme is now fully under way. The Electrical Maintenance & Construction Company, of Toronto, Ont., are the contractors in charge of the work. The entire electrical machinery, consisting of two 300-kw. S. K. C. two-phase generators, with 600-kw. in step-up and 600-kw. in step-down transformers, as well as the necessary switchboards and station apparatus, and one 50-hp. induction motor to drive the waterworks pumps and one 50-hp. induction motor to operate the arc machine, is being furnished by the Royal Electric Company, of Montreal. Rapid progress is being made, and it is expected that current will be delivered in Orillia by Dec. 1.

DR. N. H. EDGERTON, of Philadelphia, Pa., the inventor of the high tension storage battery, is building a factory at Hamilton, Ont., for their manufacture in Canada. Work on the building is progressing. A temporary building, however, has been obtained, in which the immediate requirements in that line will be manufactured as soon as they can put the machinery in place. This means another electrical industry for the city of Hamilton, which will employ about 50 men. The equipment of electrical instruments and switchboards was given to the Royal Electric Company, of Montreal, who are

to have the same in operation at once. Storage batteries for street railway purposes are to be the speciality of this concern.

AUTOMOBILE FACTORY.—It is announced that a factory, to employ 200 hands, in the manufacture of electric and gasoline automobiles ,will be established in Toronto early next year for the supply of such vehicles for the Canadian market.

TELEGRAPH CODES.—The Dominion government has adopted for use in its various departments a new telegraphic code book, issued by the Western Union Telegraph Company. It has also been made the official code for use at the Paris Exposition. This new code has advantages over the one at present in use, which, it is believed, will result in the latter being dispensed with by the public.

WESTERN PROVINCES.

GRAND FORKS.—The Kootenay Electrical Supply & Construction Company, of Nelson, B. C., has decided to open a branch at Grand Forks, with Mr. W. P. Dickson in charge.

WEST KOOTENAY.—The Canadian General Electric Company has received an order from the West Kootenay Power & Light Company, of Rossland, B. C., for another of its standard 30-hp three-phase induction motors.

VANCOUVER, B. C.—Geo. C. Hinton & Co., of Vancouver, B. C., have placed an order with the Royal Electric Company of Montreal for one of their 10-kw multipolar generators and the necessary wiring of lamps for one of their mining camps on Vancouver Island.

COLUMBIA, B. C.—A new smelter is under construction at Columbia, B. C., in connection with which an electric plant will be put in. The contract is said to have been given to the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., for two alternating current generators of 180-kw each. These will be direct connected to a 250-hp turbine.

CARBIDE.—Attention has already been directed in these notes to the experiments which have from time to time been made by Ottawa capitalists in the manufacture of carbide. Already the experimental stage has been passed, and the Bronson carbide factory, an imposing stone structure at the Chaudiere Falls, in Ottawa, will soon be finished. Within the past fortnight the announcement has been made that at the next session of Dominion Parliament, a number of capitalists will apply for incorporation to carry on the manufacture of carbide on a large scale. One of the most progressive lumbermen of Ottawa who has given much attention to the subject is convinced that by the utilization of the refuse from the saw mills, the cost of manufacture of carbide will be largely reduced, the outlay for lighting in the city brought down materially and several valuable by-products produced in the course of the process.

MILL OWNERS and manufacturers, operating at the Chaudiere Falls, Ottawa, are now very apprehensive of a dearth of power if its use is not restricted or the waste utilized. The power of the Ottawa River at the Chaudiere is largely in the hands of lessees of what are called the "water lots" owned by the government of Canada. The lessees pay $100 per annum per lot, each lot providing sufficient water to develop 150-hp. Large extra expenditures by the lessees are necessary to render the supply available. Despite improvements calculated to husband the available supply of water, the extension of existing plants and the addition of new electrical plants, have brought the power users face to face with the unpleasant contingency of a dearth of water. This condition of affairs will have the effect of forcing electrical power users to turn their attention to the hitherto neglected streams in the vicinity of Ottawa.

THE CITY COUNCIL OF OTTAWA is still discussing seriously the proposition to own and operate its own electric lighting plant. As soon as some feasible scheme can be determined upon, it is thought that it will be submitted to citizens at the approaching elections in January. Alderman Morris has a proposition of a far more economical character than the purchase of the Ottawa Electric Company's franchise and plant for $1,250,000. He has made the following statement: "I shall be in a position to submit a proposal to provide the corporation with a brand new up-to-date plant, including water power and buildings, transmission facilities and all other necessary adjuncts for the sum of $500,000, which is $750,000 less than is now asked by the Ottawa Company for an antiquated plant. My plant for electrical and power purposes would be worth to the city 50 per cent. more than the entire outfit now sought to be foisted on the city. I think that I can find the capital in New York to carry out the enterprise, provided the council concludes to go into the lighting business."

THE MONTREAL ELECTRIC STREET RAILWAY COMPANY has appealed against the assessment made by the city upon their poles, wires and rails under the new tax imposed in the city charter. The city's assessors have valued the poles, wires and rails of the company, independent altogether of their plant and machinery, at $280,000. The company have, it is understood, about ninety-six miles of single track in the city, so that the valuation is on the basis of $3000 per mile. The company claims that the valuation for a similar tax in the city of Toronto is only $1050 a mile, and they ask that their assessment should be reduced to the valuation imposed in the city of Toronto. This would reduce their assessment to something like $100,000, instead of $280,000. The company also objects to the imposition of the special business tax on the basis of the assessment of their real property, including that already taxed under the poles, wires and rail tax. The company points out that, in reality, as the law is construed by the assessors, they are being taxed no less than three times on some of their property which the city charter designated as real property.

OTTAWA STREET RAILWAY.—The work on the new power house of the Ottawa Electric Street Railway, at the Chaudiere Falls, Ottawa, is about completed, and the task of placing the waterwheels in position will be commenced at once. There are three new sets of wheels, the hydraulic machinery having been manufactured by Stillwell-Bierce & Smith-Vaile Company, of Dayton, O., who installed the machinery in the Lachine hydraulic works and at Chambly Rapids and Montmorency, Que. The machinery for the Ottawa works is now being set up. The Ottawa Street Railway Company will thus have a duplicate plant. The new plant will be used at all times except in case of accident, when the old plant will be used in its stead. The advantage of the new plant will be the dispensing with cog wheels, counter-shafts and belts. The shaft of the new set of water wheels will be common to all, and will be connected directly with the dynamo, which will run at 100 revolutions per minute. The present plant, which is operated by a counter-shaft and belt, is run at 450 revolutions per minute. The result will be that the same quantity of current can be delivered on the wires with three-quarters of the quantity of the water as is now necessary with the present power house plant, and 25 per cent. is thus saved in the expenditure of power. The new plant will be in operation by the first of the year and will be installed in a separate and absolutely fireproof building with nothing combustible within it. The building will have two metal roofs and the walls will be constructed of brick.

QUEBEC NOTES.

THE CITY OF MONTREAL has taken out suit for $6050 against the Royal Electric Company for taxes on the company's poles, which the company refuses to pay, on the ground that it is not liable.

CITY OF QUEBEC.—A lively agitation is in progress in the City of Quebec for cheaper electric light. At present the light in that city is much more expensive than that of Montreal, but active competition is expected in a few weeks when the Jacques Cartier Company commences operations in the city.

ELECTRICAL BARBERS.—It is said that there is a movement on foot in Montreal, as well as some of the other large cities of Canada, among the barbering fraternity, to follow the example set by the Parisian tonsorial artists as to the introduction of electricity into their business. In France barbers are said to be equipping their shaving and hair-cutting saloons with complete sets of electrical appliances.

LOW RATES FOR CURRENT.—All indications point to a lively rate war between Montreal's two big electric companies. On Sept. 14 the Royal Electric Company managers announced that they would cut the existing electric rate by 33⅓ per cent., and now the Lachine Rapids Hydraulic & Land Company announces that that company will make the sweeping reduction of 40 per cent. per ampere hour, or 6⅔ per cent. lower than the rate announced by the Royal.

SHAWINIGAN FALLS.—The first through train from Quebec to Shawinigan Falls over the newly constructed branch of the Great Northern Railway from Grand Mere, was a special which carried as guests of the president of the road, a large number of prominent Quebec people. On arriving at Shawinigan, the industrial works now in progress were inspected, and the party then spent some time in viewing the falls, which they are agreed in pronouncing the wildest and most beautiful of any in the province. A large hotel is to be built next season, and the immediate surroundings of the Falls are to be preserved for a park. The company expects to spend about $4,000,000 in various industrial establishments, and every effort possible is to be put forth to utilize the enormous power of the cataract.

UTILIZING THE CHATS FALLS.—One of the biggest deals ever undertaken by Ottawa capitalists was consummated a few days ago when the Chats Falls, at Quyon, in the province of Quebec, passed into the control of the Pontiac Mining Company. The enormous amount of 680,000-hp can be developed at the falls, and it is understood that the company will take steps to secure the location of industries of various kinds and of large size. These falls are about 35 miles from Ottawa. The company is making good progress with its mining property, and the acquirement of the power at the falls will enable it to direct some of this power to the development of its mines, and also to go into commercial enterprises. The purchase was carried through by Messrs. T. C. Bate, president; N. A. Belcourt, M. P.; W. J. Poupore, M. P.; P. Clark, secretary-treasurer, all of Ottawa; Denis Ryan, managing director, of St. Paul, Minn., and ex-Senator T. A. Darby, of North Carolina, U. S. A. These gentlemen bought the property as individuals, and are turning it over to the company at exactly the same figure as they paid for it. The company owns the property outright, and the directors are among the leading men of Ottawa. The capital stock of the company is $490,000. It is confidently expected that the district about the Chats Falls will witness as great development as that about the Chaudiere Falls in Ottawa.

THE CHAMBLY PLANT.—Many of the leading stockbrokers of Montreal visited the electric works of the Royal Electric Company, of Montreal, at Chambly last week. A special train took the visitors to Chambly Canton, and the first point of interest visited was the magnificent concrete dam, which extends first across the Chambly River for a distance of 550 feet, then down the river 1627 feet, and then inshore another 320 feet, forming a Z. The dam makes what is known as the head race, or supply pond, which provides the water to the power house for the generation of the electric power. The power house is a steel structure enclosed in brick. At present there are two exciters and four huge generators in operation, but there is room for four more generators, which will be placed in position as soon as the necessity arises. Each generator has a capacity of 2500-hp, making the total capacity at present 10,000-hp, and the ultimate capacity will be 20,000-hp. The generators are the largest machines of the kind that have ever yet been built, even larger than the Niagara machines. Among the visitors was Mr. W. R. Eckart, of San Francisco, the representative of the Blue Lakes & San Francisco Electrical Company, which is putting in a plant to supply power from the Blue Lakes in Nevada to San Francisco, a distance of 150 miles, with a voltage of 60,000 volts, the highest voltage ever attempted. The machinery has been ordered from the Stanley Electrical Company, of Pittsfield, Mass., the associate company of the Royal Electric, which designed the latter's machinery, and the special object of Mr. Eckart's visit was to inspect the machinery.

EASTERN PROVINCES.

MR. D. F. WIDDEN has bought out the Antigonish, Nova Scotia, electric light works.

MR. T. W. CLARK, of Bridgewater, Nova Scotia, has the contract for con-

structing a power house, wheel pit, conduit and tail race at Milton, N. S., for Liverpool's electric light system, at $2750.

PARRSBORO, N. S.—Users of electric light in Parrsboro, Nova Scotia, pay 19 cents for 10 and 30 cents for 16-cp, with an all-night service. Until lately, although the streets are well lighted with twenty-eight arc lights, enough profit was made out of the incandescent services at the prices charged, to pay for the street lighting, which in many towns would cost upward of $3000.

LIVERPOOL, NOVA SCOTIA, is installing a complete electric plant to furnish arc and incandescent lights for the streets, and incandescent lights for indoor use. The by-law was voted on some time ago, and an order has been given the Royal Electric Company, of Montreal, for a complete electrical equipment, consisting of one 75-kw S. K. C. two-phase alternating current generator with exciter and switchboard complete, also a complete switchboard and regulating apparatus for twenty-five 2000-cp enclosed alternating arc lamps for the streets, as well as the necessary transformers and materials for installing 2000 incandescent lamps within six weeks.

MEXICAN NOTES.

Austin, Texas, Sept. 25, 1899.

SEVERE ELECTRICAL STORMS have occurred recently at Merida, state of Yucatan, and the electric light plant in that city has been considerably damaged by the unusual disturbances.

MR. ISIDORE STERNFIELD, a prominent electric machinery man of the City of Mexico, has returned from an extended visit to several of the principal cities of the United States. He reports having had a very enjoyable time.

MR. HENRY T. LERVENT, an electrical engineer, who went to Mexico from Pittsburg, Pa., recently, has organized a company to construct an electric street railway system in Durango, Mexico. Mr. Lervent is now in the City of Mexico on business for his company.

MR. ALBERT EDWARD NORSWICK, electric engineer for the Federal District Street Railway Company, of the City of Mexico, is making an extended visit to his old home in Canada. He expects to return to the City of Mexico about Oct. 15. He is understood to have been buying apparatus in the States.

TROLLEYS FOR CUERNAVACA.—It is announced that the work of establishing an electric street railway system in the City of Cuernavaca, State of Morelos, Mexico, is to be pushed to an early completion. Cuernavaca is situated on the line of the Mexico, Cuernavaca & Pacific Railroad, and is a noted health resort for the people of Mexico.

THE MONTE ALTO LINE.—One of the most remarkable tramways in the world is the line which runs from Monte Alto, a station on the Mexican National Railway in Mexico, into the mountains, a distance of 25 miles. This line has been operated for several years by means of mules, and the little animals had many hard struggles hauling the heavy empty cars up the mountain side to the charcoal camps where the loads of charcoal were taken on and hauled with ease down the steep decline. The road has been a paying investment and the new owners have just purchased locomotives and will substitute them for the patient mules.

MR. ERNESTO PUGIBET, a wealthy business man of the City of Mexico, went to Paris, France, a few weeks ago for the purpose of submitting a proposition to capitalists of that city for the building of a system of electric street railways in the several suburban towns of the City of Mexico. He has written friends in the City of Mexico that he has met with success in his mission and that he has perfected arrangements with a French syndicate to undertake the extensive enterprise as soon as the preliminary work can be accomplished. Mr. Pugibet will shortly return to the City of Mexico accompanied by a representative of the syndicate. It is understood that the Mexican government will be asked to grant a concession for the enterprise. Mr. Pugibet has been engaged in the cigar manufacturing business for many years. He established the great El Buen Tono cigar factory in the City of Mexico and has made a big fortune out of the business. His cigar factory employs over 2000 workmen.

STREET RAILWAYS.—It is authoritatively announced that the Federal District Street Railway Company, who own and operate the extensive street railway system in the City of Mexico, have purchased the street railway system in the city of Puebla, Mexico, from Leonardo and Mariano Fortuno. Certain valuable water power rights, available for electric power, located near Puebla, are included in the purchase. The new owners will immediately commence the work of converting the system into electric lines. The purchasing company is composed of English capitalists, who own and operate the street railway systems in Cape Town and other cities of South Africa. This company has an option on the extensive street railway system of Guadalajara, the second largest city in Mexico. It is expected that this option will be closed and the sale formally consummated very soon. The owners of the Guadalajara street railway system are Mexican capitalists. It is understood that the amount of money involved in the proposed transaction is very large owing to the great earning capacity of the system. The amount of money paid for the Puebla system has not been made public.

General News.

THE TELEGRAPH AND TELEPHONE.

NEW LONDON, CONN.—The New London Telephone Company has filed articles of association with the secretary of state.

NEW YORK, N. Y.—The New Telephone Incorporation has been formed to establish a telephone line. Capital, $10,000. Incorporators: W. G. Conklin, E. Ashforth, Z. M. Knowles, all of New York City.

LE ROY, N. Y.—The Le Roy Gas & Electric Company has been formed for manufacturing gas and electricity. Capital, $35,000. Incorporators: S. D. Purdy, of Buffalo; B. Ward, of Le Roy; C. F. Pond, of Rochester.

UNION CITY, IND.—The Union City Telephone Company has been formed to operate a telephone exchange. Capital, $20,000. Incorporators: J. P. Horick, A. J. Verntner, M. H. Mendenhall, O. K. Green, J. A. Shockney, G. W. Patchell, H. C. Huesmann, T. Shockney, all of Union City.

ROME, N. Y.—The Constableville & West Leyden Telephone Company has completed connections with this city and Lee Line, Lee Center, Stokes, Delta, West Branch, Ava and West Leyden. Among other places to be connected on the line are Constableville, Boonville, Turin, Lowville, Mohawk Hill and other northern towns.

PITTSBURG, PA.—The Federal Telephone Company, of Pittsburg city, received a charter from the State Department at Harrisburg, authorizing it to transact business as a corporation and designating Pittsburg as its principal office location. The incorporators of the new company are lawyer Joseph C. Forse, Fred Deland and Joseph McClure, all of Pittsburg. The purpose of the corporation is to consolidate the many small independent concerns operating in outside towns. This will effect a strong organization and the consequent extension of the lines will add greatly to the efficiency of the service.

ELECTRIC LIGHT AND POWER.

NEW RICHMOND, MINN.—The city council has purchased the electric light plant from the New Richmond Electric Light Co., the price being $10,000.

RICHMOND, KY.—In the case of Hume Bros. against the Richmond Electric Company, for the appointment of a receiver, S. E. Scott was appointed receiver, both sides agreeing to his appointment.

NEWARK, N. J.—The Washington Electric Light & Power Company has been formed. Capital, $150,000. Incorporators: Samuel A. Foster and Abram L. A. Himmelwright, Newark, N. J., and Henry W. Schloss, New York.

DENVER, COL.—The Mariposa Consolidated Gold Mining & Electrical Power Company has been formed for mining and supplying electric power. Capital, $500,000. Incorporators: E. C. Hahn, G. G. Ligluri, J. C. Doyle, J. E. Budd, J. W. McCarthy, all of Denver.

THE ELECTRIC RAILWAY.

ANNISTON, ALA.—The consolidation of the Nob and Oxford Lake lines, the Anniston Gas Works and the electric light and power plant has been effected.

GREENFIELD, O.—The Indianapolis & Greenfield Rapid Transit Railroad bonds have been purchased by Cleveland capitalists. The contract for the construction of the line has been awarded to the Kirkpatrick Construction Company.

BATTLE CREEK, MICH.—The Battle Creek, Albion, Marshall & Jackson Street Railway Company has been granted a thirty years' franchise. W. E. Avery, of Detroit, is the promoter of the line and work will be commenced immediately.

BUFFALO, N. Y.—Contracts for a new trolley line between Buffalo and Depew have been entered into between the Buffalo & Depew Electric Railroad Company and the Tennis Construction Company, of Philadelphia. The contracts call for the erection of a power station and car barn and the furnishing of a number of cars of the latest pattern.

BUFFALO, N. Y.—The incorporation of the Buffalo, Fredonia & Dunkirk Railroad Company, with a capital stock of $1,000,000, promises a great deal for the three cities as well as intermediate points. The new line will be double-tracked, and about 50 miles long. It will start from Buffalo and run to Dunkirk and Fredonia. It will touch at West Seneca, Athol Springs, Irving, Angola, Farnham, Lake View, Bay View, and Silver Creek.

THE AUTOMOBILE.

MINNEAPOLIS, MINN., is to have an electric vehicle company, with a capital stock of $250,000. Some fifty vehicles are expected as a beginning, of which thirty will be cabs. S. N. Smith, of the Temple Court, that city, is pushing the enterprise.

MIDDLETOWN, CONN.—At a meeting of the stockholders of the Keating Wheel Company of Middletown, Conn., it was unanimously voted to increase the capital stock to $5,000,000, and to change the name to the Keating Wheel & Automobile Company. The present capitalization is $250,000.

LEGAL.

TELEPHONES AND RAILROADS.—It is believed that American Telephone & Telegraph Company will appeal to the Supreme Court from the ruling of Judge Townsend granting the application of the Florida Central & Peninsular and Southern Railway for a temporary injunction restraining the Telephone Company from erecting its lines along the railroads.

CARBORUNDUM LITIGATION.—Argument was concluded last week in the United States Circuit Court of Appeals, Philadelphia, in the case of the Electric Smelting & Aluminum Company against the Carborundum Company. The bill in equity was filed in the Circuit Court for the Western District of the

state to have the defendants restrained from making an alleged infringement on the complainants' patent process for smelting ores by electricity and upon a patented electric smelting furnace. Judge Buffington dismissed the bill, and the appeal was taken by the Electric Company. Decision was reserved.

TESLA POLYPHASE PATENTS.—A decision was handed down last week by Judge MacPherson, of the United States Circuit Court of the Eastern District of Pennsylvania, sustaining two Tesla patents in a suit for infringement against Scott & Janney. These patents relate to the split-phrase method of obtaining a rotary field from a single alternating current. The judge quoted with approval the following theory of polyphase alternating-current motors as covered by the Tesla patents: "His broad invention expressed in a few words was a production, by means of two or more alternating currents differing in phase, of a shifting or rotating magnetic field as distinguished from one in which the poles or points of maximum attraction were merely alternated in pole polarity, either with or without variation in strength." The patents in question cover the splitting of a single current into two currents and obtaining a requisite difference of phase by induction; and also splitting a single current into two currents by dividing the path of the single current and obtaining requisite difference of phase by making the two branches of the main path of different electrical character. The ideal difference in phase of 90 degrees can only be obtained by the employment of different sources of current, but sufficient difference of phase for all practical purposes is secured artificially in the Tesla split-phrase motors and in that of the defendants; the court considers that the general law of operation is the same in both cases, and concludes that the defendants' motor infringes all the disputed claims of the patents in suit.

PERSONAL.

MR. J. G. WHITE, of the electrical engineering firm of that name, leaves Europe for home on Oct. 4.

MR. LUIS E. REYES, E. E., of San Luis Potosi, Mexico, is on a visit to this country on telephone business.

MR. M. J. INSULL, of the General Incandescent Arc Light Company, is expected home from England this week.

MR. H. BEVIS, of the General Electric Company, Ltd., of England, is on a trip to this country, and will arrive about October 11.

MR. N. DOULSKY has succeeded Mr. Haberzettel as engineer, traction department, Vladikavkas Railway Company, Rostoff-on-Don, Russia.

PRES. E. M. BARTON, of the Western Electric Company, has sailed for Europe, it is stated, on business connected with the enlargement of its factories in England and on the Continent.

SIR JAMES PENDER, BART., M. P., and Lady Pender were among the arrivals by the Cunard steamer Campania on Saturday last. It is understood that they are here chiefly for the international yacht races.

MR. W. H. BANES, of Seattle, Wash., has accepted the position of manager and purchasing agent of the Villisca (Iowa) Electric Company, succeeding Mr. H. C. Stoddard, who has resigned and sold out. Under the management of Mr. Banes several new lines are now being constructed.

MR. WILLIAM S. CONANT, E. E., of the consulting engineering firm of Smith & Conant, Detroit, has been made managing director of the Northern Engineering Works, designers and manufacturers of cranes, machinery and equipment for foundries and the "Peerless" gas engine. This company have recently acquired and occupied the plant of the old Frontier Iron Works in Detroit, which it has re-equipped and modernized to suit the needs of the new output.

OBITUARY.

MR. JOHN CONNOR, who was well known throughout the West as an electrical contractor, died at his father's home near Madison, Wis., after a long and severe illness last week.

MR. MICHAEL S. CORBETT, Detroit manager of the Western Union Telegraph Company, died at Harper Hospital, in that city, on Sept. 26. He was forty-one years old. He began working for the Western Union in 1876.

MR. CARL EDELHEIM. The death is announced, in Philadelphia, of Mr. Carl Edelheim, one of the directors of the Cutter Electric Manufacutring Company and father-in-law of Mr. A. E. Newton, of that company. He was born in 1844 on his father's estates, near Hamburg, Germany, and was educated by tutors. At the close of the Civil War he took up his residence in New York. In 1876 he went to Philadelphia, where he had since resided. Soon after he became sole proprietor of the famous Fleischmann Vienna Model Bakery. He married Miss Caroline Fleischmann and had four children, the eldest of whom is the wife of Mr. Newton. The three younger children are unmarried. Mr. Edelheim was a member of several clubs in New York and Philadelphia, notably the Art, Philobiblon and Grolier Clubs. He was also a trustee of the Pennsylvania University Archæological Society. He aided liberally in the advancement of all movements which promoted the best interests of music and painting. His house was filled with choice specimens of bric-a-brac, and he possessed a rare collection of books.

Trade and Industrial Notes.

THE WESTERN ELECTRIC COMPANY has distributed among the trade their Petite Alternating Current Arc Lamp Catalogue. Any of the readers who have not received this catalogue will do well to write for a copy.

BAIRD TIME STAMPS. The Baird-Chandler Manufacturing Company, of 114 Clinton Street, Chicago, have met with great success with their time stamps and chronograph, which are in use for a variety of purposes all over the country. They run well, wear well and keep good time. The concern also make a specialty of advertising clocks, and invite correspondence.

HOPPES MANUFACTURING COMPANY, of Springfield, O., have issued a neat illustrated pamphlet of their steam separators, oil eliminators, live steam feed water purifiers and exhaust steam feed water heaters. It abounds in details as to the apparatus, and will be sent to any address.

THE STERLING ELECTRIC COMPANY, of Chicago, will furnish the switchboard and office equipment for the new independent telephone exchange at Brodhead, Wis. This apparatus will be of the "Bell-style," manufactured exclusively by the Sterling Company for the independent field.

CROWN WOVEN WIRE BRUSH CO., Salem, Mass., have an excellent specialty and invite the attention of all who have dynamos or motors, to their commutator compound and their woven wire brush. Both are well known and in wide use. They invite inquiries and will send data, testimonials, etc.

THE UNITED ELECTRIC HEATING COMPANY report the demand for their heating devices as being greater than ever before. Among some of the numerous orders recently received is one for the complete equipment with laundry irons, etc., of the laundry of the Eastern Michigan Asylum for Insane at Pontiac, Mich.

THE CROSS OIL FILTER made by the Burt Manufacturing Company, of Akron, O., is now in use in 23 foreign countries and during its nine years of use in the United States has received endless endorsements. It is strongly made, neat in appearance, and does its work with great efficiency and economy. The sizes run from 15 to 150 gallons per day, filtering capacity.

OHIO ELECTRIC WORKS, of Cleveland, O., claim to be headquarters for the smaller electrical novelties and have a big line of specialties. They state that their export trade during the past year has more than doubled and that they can furnish their trade printed matter in any language. They will be glad to receive orders and inquiries, which will be given prompt attention.

THE ELECTRIC APPLIANCE COMPANY, Chicago, are mailing upon application numerous copies of their Packard transformer catalogues. These pamphlets, besides giving prices, contain articles on "Transformers and Their Profitable Use," by Prof. Dugald C. Jackson, and on general instructions for testing transformers. They are full of valuable data for the transformer user.

ELECTRIC STORAGE BATTERY COMPANY, in Circular No. 53, give an interesting illustrated account of a chloride accumulator installation in the apartment house on the southeast corner of 117th street and Lenox Avenue, New York. It comprises sixty cells. The building is wired for 1200 lights, and has an electric elevator. Marked economy and smoothness of operation are shown.

INGLIS WIRE LAMP GUARDS.—Wm. Inglis Wire & Iron Works, Detroit, Mich., are well known as makers of wire lamp guards, and are now pushing their No. 10 which, besides having all the good features of preceding styles, has the advantage of taking up very little shelf room in a supply department or in a store. It is known as the "New Century." The Company will be glad to send their catalogue of these goods to any address.

JOHN A. ROEBLING'S SONS COMPANY have sent their friends a very timely memento of the present patriotic occasion. It is a handsome embossed card in colors. At the top is a fine portrait of Dewey in a wreath. At the bottom is outlined a staff flying an admiral's flag. Toward the portrait is extended a hand holding a glass of wine, and above it is the sentiment, "Gentlemen, the Admiral." There is a toast, which perhaps even Mr. E. Atkinson would join in.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY report that since the "central energy system" has been well demonstrated in actual exchange operation, they have received orders for nearly 25,000 instruments and accompanying multiple switchboards, in various parts of the United States. They also had a large number of calls in many foreign countries. Their "central energy system" has been in actual operation for nearly three years.

INSULATING VARNISH.—The Eagle Paint & Varnish Works, of Pittsburg, invite the severest tests of their insulating varnish, which is peculiarly adapted for use on all bare metal surfaces, armatures, armature cores, field coils, switch bases, etc. It has undergone some remarkable tests under all conditions. It is not affected by oils, water, acids, heat or cold, does not corrode, remains tough and elastic under all conditions, bakes easily with an even coat at about 200° F. in 8 or 10 hours, and dries without baking in about 24 hours when exposed to the air. The directions for use are easy to follow.

A SWISS FACTORY IN AMERICA.—The Henri Nestle Company, manufacturers of Nestle's Food, are establishing a large plant at Fulton, N. Y., for the production of their specialties in the United States. This firm has its headquarters at Vevay, Switzerland, and before establishing its plant in America had already constructed a similar plant in Sweden. The plant at Fulton, N. Y., will be fireproof, and of the most modern construction, using steel framework for the floors and roofs, with brick side walls, the floors being constructed of concrete supported by steel beams. The Berlin Iron Bridge Company, of East Berlin, Conn., furnished and erected all the steel structural work connected with this building, under the supervision of Mr. H. J. White, consulting engineer for Henri Nestle.

HIGH CLASS RHEOSTATS.—The Cutler-Hammer Manufacturing Company, of 182 W. Jackson Boulevard, Chicago, make a high grade of rheostats which are used by the majority of the motor builders of the United States and which are therefore to be found everywhere. They are also in use by the United States Navy. The concern have devoted six years to the design and manufacture of this class of apparatus, and to correct design add the best materials and the highest skill in workmanship. All apparatus is given two separate and severe tests before shipment. While prices are perhaps a trifle above the ordinary they are lower in view of the quality of the apparatus. They carry 2000 or more of these special appliances in stock and can make prompt shipments of motor starters, motor speed regulators, etc., on the shortest notice.

Record of Electrical Patents.

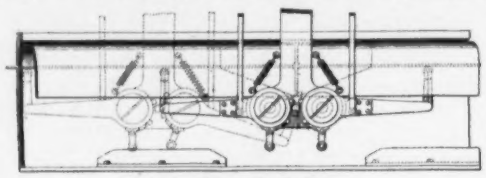
UNITED STATES PATENTS, ISSUED SEPT. 26, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

633,558. ELECTRIC RAILWAY; R. W. Barkley, New York. App. filed Oct. 23, 1893. At the lower end of the plough are two pivoted arms intended to swing vertically upward to engage the conductor and this motion is obtained by suitable cams located in the conduit and adapted to engage with rollers on the pivoted arms.

633,565. DEVICE FOR LIGHTING LAMPS BY ELECTRICITY; H. M. Brigam and S. M. Meyer, New York. App. filed Feb. 5, 1898. A device comprising a sliding bar, mounted on the lamp burner, and carrying a resistance of platinum wire to be rendered incandescent by a current. The movement of the bar serves to throw the resistance into contact with the wick, and also to close a circuit through the resistance.

633,576. CASING FOR, AND MOUNTING OF, ELECTRICAL FUSES OR CUT-OUTS; L. W. Downes, Providence, R. I. App. filed Jan. 12, 1899.



633,558.—Electric Railway.

The object is to enable the lineman to refuse the circuit on dead terminals instead of on live terminals as is usually the case. The fuse box is made in two parts, one of which engages permanently with the live terminals and the other carries the fuse and contacts which engage with the live terminals when it is adjusted to the first part. In this way, by removing the second part, the fuse can be handled in perfect safety.

633,577. CASING FOR, AND MOUNTING OF, ELECTRICAL FUSES OR CUT-OUTS; L. W. Downes, Providence, R. I. App. filed Jan. 28, 1899. A modification of the preceding.

633,594. ELECTRIC TRACTION OF RAILWAY TRAINS; O. H. E. Kaselowsky, Berlin, Germany. App. filed July 1, 1898. On each train there are two controlling stations and the arrangement is such that the actuation of the separate motors on the cars is only possible in case of the agreement of both controlling stations, consequently neither operator can start the train against the will of the other, but each can independently stop the train.

633,608. ADVERTISING STREET ANNUNCIATOR FOR CARS; P. H. Petriarche, Toronto, Canada. App. filed May 16, 1898. The device is operated by the main current by means of a circuit closer at each street, the invention relating more particularly to the details of construction.

633,623. STREET INDICATING DEVICE FOR STREET CARS; S. Squire and A. Knowles, North Bedford, Mass. App. filed July 21, 1898. This is a street indicator with arrangements for operating it by a push button from either end of the car.

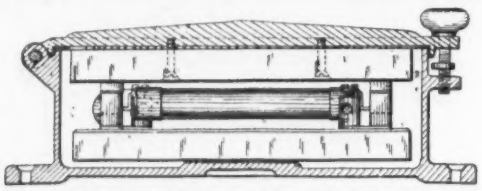
633,641. DYNAMO ELECTRIC MACHINE; C. A. Ecke, Newark, N. J. App. filed July 28, 1899. Improvements relating to the brush holder, which has two superposed compartments for the brushes, parallel to each other, and a fastening piece arranged at an angle to the compartments.

633,668. COMPOSITE WIRE AND PROCESS OF MANUFACTURE; Orlando M. Thowless, New York, N. Y. App. filed March 4, 1899. (See Current News and Notes.)

633,690. APPARATUS FOR REPRODUCING MOTION; A. Franke, Berlin, Germany. App. filed Feb. 23, 1899. The transmitter has two sets of multiphase windings for producing oppositely rotating fields and the receiver has two sets of multiphase windings for the same purpose. Two armatures are electrically associated and subjected to the influence of the fields of the transmitter and receiver.

633,695. MOTOR METER FOR THREE-PHASE CURRENTS; Georg Hummel, of Munich, Germany. App. filed Dec. 27, 1897. (See Current News and Notes.)

633,702. ELECTRICAL MEASURING AND INDICATING APPARATUS; C. F. Rodde, Gross Licherfelde, Germany. App. filed May 11, 1899. In connection with the instrument is a circuit-controlling device connected with a secondary circuit, a movable needle of the measuring instrument is adapted to swing into and out of position for engagement with the circuit-



633,576.—Casing for and Mounting of Electrical Fuses or Cut-Outs.

controlling device and an actuated lever is adapted to move the needle when the same is in a predetermined position, whereby the circuit-controlling device is governed and the secondary circuit is in turn controlled.

633,771. SWITCH FOR ELECTRIC CIRCUITS; G. Wright and C. Aalberg, Wilkinsburg, Pa. App. filed Jan. 30, 1899. To avoid the gripping engagement between the terminals found in the well known knife switch, this switch is constructed with two contact faces and a laminated bridging member having beveled ends for engagement with the faces of the respective contacts.

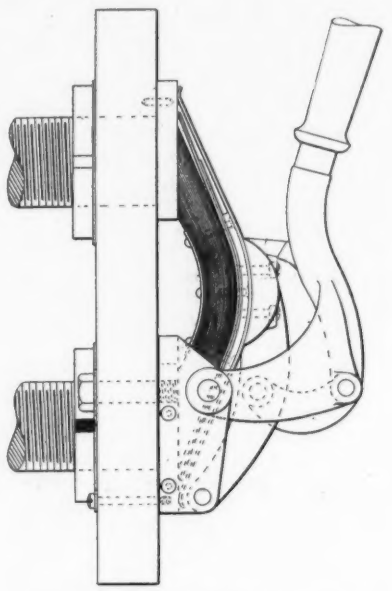
633,772. AUTOMATIC CIRCUIT BREAKER; G. Wright and C. Aalberg, Wilkinsburg, Pa. App. filed March 23, 1899. Improvement on the preceding, with additional automatic features.

633,773. CIRCUIT BREAKER; G. Wright, Wilkinsburg, Pa. App. filed March 23, 1899. Improvements on the two preceding inventions, consisting of toggle-levers for closing the switch and constituting the means for locking the same.

633,786. TROLLEY STAND; H. W. Brookes, Braddock, Pa. App. filed July 6, 1899. The trolley arm is mounted at the base on a universal pivot.

633,801. MEANS FOR UTILIZING GALVANIC CELLS OR BATTERIES; R. D. Castro, New York. App. filed July 28, 1898. The cells of the battery are brought into action successively and for brief periods so that each may have short intervals for recuperation. This result is attained by means of a rotating switch.

633,829. STATIC ELECTRIC MACHINE; J. Gallegos, San Jose, Guatemala. App. filed June 81, 1899. A static induction machine comprising a series of stationary coils and means for connecting them with a supply of static electricity, movable coils arranged to pass adjacent to the stationary coils, and collecting devices for connecting the movable coils with the ground when they register with the stationary coils, and for connecting the movable coils with a consumption apparatus when they are in a position between the stationary coils.



633,771.—Switch for Electric Circuits.

633,855. SYSTEM OF ELECTRICAL DISTRIBUTION; Benjamin G. Lamme, Pittsburg, Pa. App. filed Jan. 30, 1899. (See Current News and Notes.)

633,856. DISTRIBUTED WINDING FOR ELECTRICAL MACHINES; Benjamin G. Lamme and John P. Mallett, Pittsburg, Pa. App. filed Feb. 6, 1899. (See Current News and Notes.)

633,857. DYNAMO ELECTRIC GENERATOR; Benjamin G. Lamme, Pittsburg, Pa. App. filed April 1, 1899. (See Current News and Notes.)

633,858. FIELD MAGNET COIL FOR ELECTRICAL MACHINES; Benjamin G. Lamme, of Pittsburg, Pa., and Charles E. Skinner, Wilkinsburg, Pa. App. filed June 24, 1899. (See Current News and Notes.)

633,887. ELECTRIC RAILWAY RAIL BOND; Thomas G. McTighe, New York, N. Y. App. filed May 24, 1899. (See Current News and Notes.)

633,920. SYSTEM OF ELECTRICAL DISTRIBUTION; Lewis B. Stillwell, Niagara Falls, N. Y. App. filed May 24, 1899. (See Current News and Notes.)

633,969. AUTOMATIC ELECTROMAGNETIC FRICTION BRAKE; Egbert M. Tingley, Pittsburg, Pa. App. filed May 18, 1899. (See Current News and Notes.)

633,971. TRAIN LIGHTING SYSTEM FOR ELECTRIC RAILWAYS; C. R. Hill, Wilkinsburg, Pa. App. filed April 14, 1899. In a lighting system for railway vehicles embodying positive, negative and neutral contact-conductors, a car or train provided with two current-collecting devices arranged to severally engage one or both of the positive and negative contact conductors and two sets of lamps severally connected between the respective collecting devices and the neutral conductor. This is to avoid putting out the lights and short circuits.

633,972. CURRENT COLLECTOR FOR ELECTRICAL MACHINES; Benjamin G. Lamme, Pittsburg, Pa. App. filed June 5, 1899. (See Current News and Notes.)